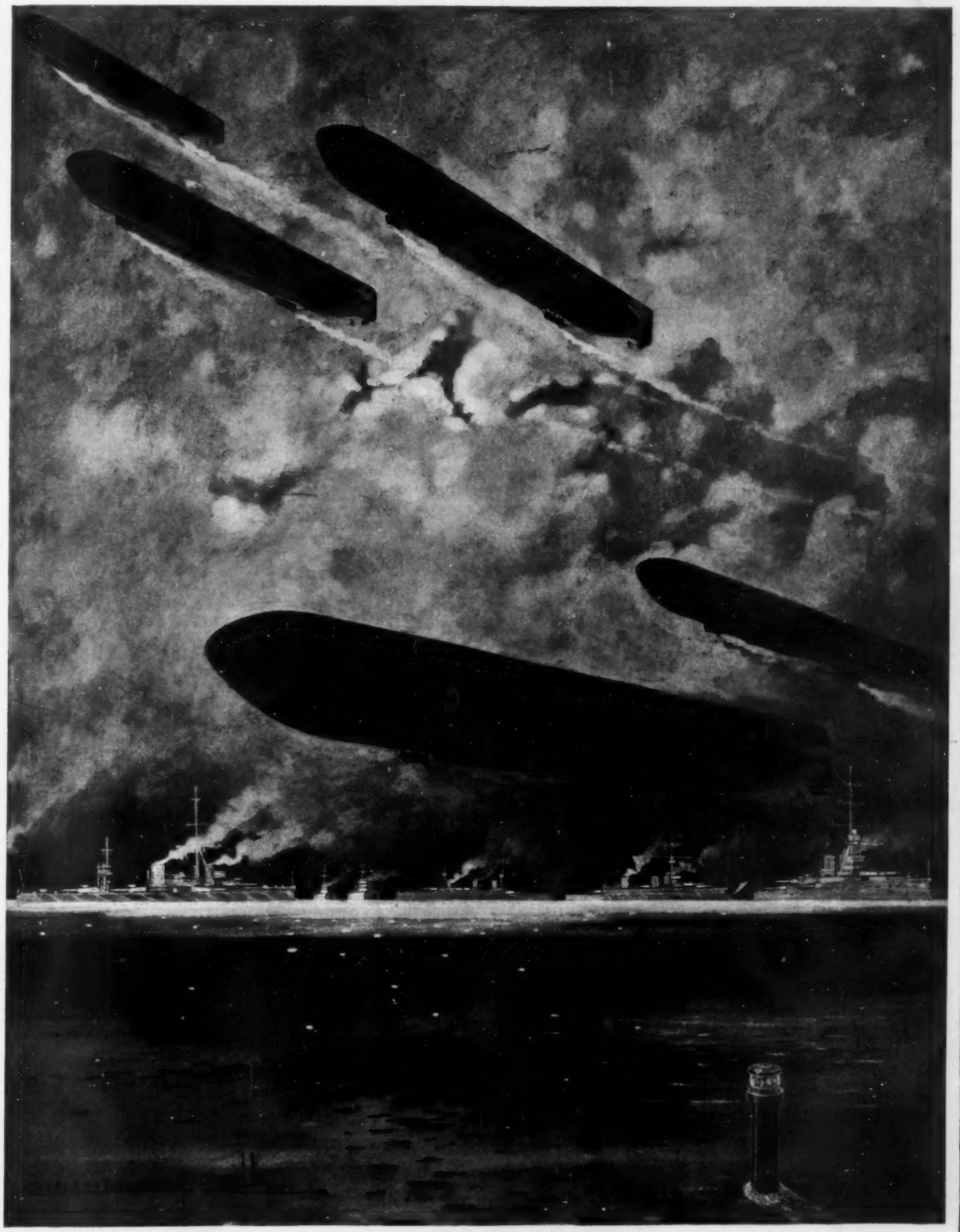
SCIENTIFIC AMERICAN



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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

The Military Value of Airships

THE recent raid of German aircraft on England and the dropping of bombs on English coast towns confirm the view which military engineers of all nationalities long ago expressed when they discussed the efficacy of large dirigibles in technical journals. Although twenty or more bombs were cast upon the Norfolk coast towns, the damage to property and the loss of life was anything but what we had been led to expect from the terrible accounts of a Zeppelin's destructiveness with which we were regaled in the daily press before the war. Even the moral effect of such attacks must be slight, if they are often repeated. If Rheims went more or less placidly about its business despite steady bombardment, as we are told, it is not likely that the English will be very much intimidated by exploits such as those of Antwerp and Yarmouth. Indeed, whatever moral effect there may be is more likely to redound to the disadvantage of the attacker. After the bombardment of Scarborough and Hartlepool, the English recruiting offices were thronged with angered volunteers. A similar result will undoubtedly follow the attack from the air upon the Norfolk coast towns.

If, then, the giant airship has not lived up to popular expectations, what is the good of it at all? It must have its uses. The Germans have not without reason persevered in the face of disaster after disaster in bringing their airships to a pitch of perfection which has aroused the admiration of aeronautical engineers in all countries. To us it seems that while the Zeppelins and other dirigibles have not been conspicuously successful in military operations, they have a useful function to fulfill at sea. A vessel which can stay in the air for thirty-six hours, which can travel at an average speed of from forty to sixty miles an hour, which is equipped with wireless apparatus of considerable range, which can hover over a single spot for hours, if need be, may obviously perform a very useful service in locating that fleet of dreadnoughts which is Great Britain's chief bulwark of safety. We have not the slightest doubt that the location of the principal British ships is accurately known to the Germans, thanks to their fast dirigibles. Of the dirigible's value in reconnoitering we had ample proof when the "Hogue," "Aboukir," and "Cressy" were sunk—three British ships which were sighted by a Schütte-Lanz airship, whose commander wirelessed their location to his base with the result that a German submarine was able to find them and sink them in a fraction of the time which would have been entailed had ordinary sea-scouting been resorted to.

The enormous size of the rigid dirigible has perhaps been the chief reason why it has proven so ineffective upon the field of battle. Let us not forget that land-scouting can hardly be effectively conducted at heights greater than five thousand feet, that anti-aircraft guns have a range of fully twenty thousand feet, and that an airship as big as the average ocean steamer is a mark far more easily found at five thousand feet than a small aeroplane. At sea it is otherwise. Battleships can be sighted and identified from great distances far out of gun range. An area of several hundred square miles can be safely explored from a height of four thousand to five thousand feet. By means of its powerful wireless plant the airship is in constant communication with its base. Who knows but the naval raid upon Scarborough and Hartlepool was undertaken only after a very careful reconnaissance, which revealed the location of every important British battleship and cruiser, and which enabled the German naval officers to time their operations so that they might carry out their purpose unmolested by a fleet in the vicinity?

And this brings us to the consideration that, if the proper sphere of the Zeppelin is that of naval scouting, it is a prostitution of those wonderful ships of the air to use them for the night-raiding of undefended towns and villages. Not alone do these raids, as we have shown, stimulate the military ardor of the British, but they serve to arouse a widespread indignation, on the ground that such raids are contrary to humanitarian principles as embodied in the findings of the Hague convention. The Hague principles demand that war shall be waged with the least possible injury to non-combatants; and, to this end the convention prohibits the bombardment of undefended towns, and demands that where bombardment is undertaken due notice shall be given so as to enable the non-combatants to withdraw.

The Shipping Bill Fallacy

ALTHOUGH the question of the upbuilding of our merchant marine and the scope and character of the governmental assistance which should be given to assist in its resuscitation is full of complexities, there is one fundamental fact in the situation which is clearly understood by the shipping men, by the private citizen, and even by Congress itself.

We refer to the fact that, because of the better food, better accommodations, higher pay, and other advantages conferred upon the American seamen by the navigation laws of the United States, the cost of running an American ocean-going steamship is so much greater than the cost of running a ship under a foreign flag, that successful competition in the deep-sea trade is an absolute impossibility.

Time was, moreover, when it cost very much more to build a ship in American yards than it did in foreign yards; but the margin of that difference has been gradually reduced, until now it is comparatively negligible in comparison with the vast difference in the cost of the operation of ships.

Everybody knows that we have failed to build up a modern merchant marine, and everybody knows just why we have failed. To-day the Government, with the strong backing of the President, recognizing the failure of private enterprise, wishes to go into the shipping business itself and fly its flag over a fleet of Government-owned ships, hoping thereby to build up an American merchant marine, and promising, when the new venture is fully established, to withdraw in favor of private operation and ownership.

We wish to put ourselves on record as stating, first, that the whole scheme bristles with fallacies; secondly, that the latest trade returns show that a Government-owned fleet is unnecessary; thirdly, that it will work injustice to the private owners of ocean-going ships; and, last and most important of all, that this shipping bill may well prove to be a snare which will sooner or later entangle us in the great European war.

In the first place, the Government is violating one of the fundamental, if unwritten, principles upon which government is based if it enters into a business enterprise in competition with the private interests of its citizens. Such action would be wrong in any case, and it is particularly vicious when the interests against which the Government will compete are already having the greatest difficulty in keeping their heads above water. It should be the policy of the Government to encourage our struggling merchant marine, not to drive it from the seven seas!

Furthermore, the plea of the President that the war has so disorganized the carrying trade that there are not enough ships to handle our imports and exports, has been completely demolished by the recent trade returns, which show an increase of exports for December, 1914, over those of December, 1913, of over $13,000,000. As we said at the outset, facts are what we should keep our eyes upon, not theories. And if ever cold, hard facts demolished a plausible theory, these trade returns for December have swept away the one plausible plea that has been made for this ill-conceived Government-ownership scheme.

Be it remembered, also, that in the very nature of things an enterprise which private capital and the best brains of the country have failed to make profitable can never be run at a profit if handled by the Government. Our humanitarian navigation laws render it certain that Government-owned fleets will be run at a loss. That loss must be made good from the Treasury, and to this extent the proposed Government-owned fleet will become a tax upon the people—a manifest injustice.

The last and, surely, the most important objection of all against this fatuous bill is the grave and ever-present danger which it will introduce in the international situation. The right of search on the high sea exists and is recognized; contraband of war is liable to find its way into the bottoms of ships, whatever flag they fly; and a situation is conceivable in which the right of search might be exercised on a ship that was sailing under the Government flag.

Is the Presidential hand which wrote the so-called "Declaration of Neutrality" prepared to sign a measure which might easily upset, in a single day, the neutral attitude which the President's proclamation has thus far so successfully assured?

The Real Cause of the Italian Disaster

BURIED away in the many columns of news published during the past few days on the subject of the dreadful Italian earthquake is the following paragraph:

"Here and there throughout the devastated districts ones sees houses standing and apparently undamaged, although surrounded by the ruins of houses that were shaken into a mass of débris by the earthquake. These houses that remain standing are modern structures built of re-enforced concrete, and in the districts where the full force of the convulsion was felt they were about the only ones able to resist the disintegrating effects of the earthquake. The others, even when solidly built of stone, collapsed like so many houses of cards."

This paragraph, together with the fact, not stated but readily inferable from the above, that the occupants of these undamaged buildings suffered no injury from the earthquake, is quite the most significant thing that has been published about the disaster. It requires, however, some comment, because, standing alone, it might suggest the idea that re-enforced concrete is the only building material that insures safety from the effects of earthquakes, whereas, in fact, the mode of construction is a much more important factor of safety than the material.

An earthquake which, occurring in a region notoriously subject to seismic shocks, takes toll of thousands of lives and millions of dollars' worth of property is, at the present day, a stupendous anachronism. That earthquake disasters in such regions are almost wholly preventable is no new idea, yet so little is this fact taken to heart that again and again we are called upon to extend unqualified sympathy to a nation which is really suffering from the stupidity or indifference of the persons who control its destinies rather than from the malignant disposition of Mother Nature.

The art of earthquake-proof construction is no longer in its infancy. For at least twenty-five years it has occupied the attention of seismologists, architects, and engineers—in Japan, Italy, Austria, the United States, and elsewhere. We have not space here to present a *résumé* of this subject, but it is timely to quote a recent assertion of M. Montessus de Ballore—the foremost French seismologist—that the art has now reached such a degree of perfection that only a few minor details are still a subject of controversy. Briefly stated, the secret of making a building safe from earthquakes is to use sound materials in its construction and tie them together securely. According to the authority just quoted, at least four fifths of the damage wrought by earthquakes is due to the neglect of the ordinary requirements of sound construction—leaving the special dangers of earthquakes out of the question—while the remaining one fifth could be largely eliminated by an intelligent location of buildings with regard to known conditions of stability in the ground. The possibility of constructing buildings capable of withstanding even the most violent earthquake shocks is happily illustrated by the same writer in his comparison of an earthquake-proof building to a ship. Marine architecture takes account of shocks and vibrations altogether analogous to those occurring in an earthquake. A ship on dry land would not be injured by an earthquake, nor would her crew suffer any worse inconvenience than a possible breaking of tableware, such as may occur in a heavy sea.

After visiting the scene of the great Messina-Reggio earthquake in 1908, Prof. Omori expressed the opinion that out of every thousand persons killed in that worst of earthquake disasters, 998 must be regarded as victims of the faulty construction of houses. This opinion was based upon a comparison of the earthquake in question with that which visited the city of Nagoya, Japan, in 1891. The intensity of earthquake motion at Messina was slightly less than that at Nagoya; yet while only 190 people were killed out of a population of 165,339 in the Japanese city, there were 75,000 deaths in Messina, with a population of about 100,000. The Japanese buildings were designed to withstand earthquake shocks, while the Italians were not.

After the Messina earthquake regulations were laid down to insure a proper method of reconstructing the buildings, but it is understood that these regulations have not been adhered to, and hence the Sicilian town is likely to be the scene of another great disaster.

Science

The Collins-Day South American Expedition left this country at the end of December for a journey across South America by way of La Paz, Cochabamba, and the Mamoré, Madeira, and Amazon Rivers. Besides exploring, this party will make extensive zoological collections for the Field Museum, of Chicago, and the American Museum of Natural History in New York.

A New Capital for Nigeria.—A recent change in the map of Africa was the amalgation of the former colonies of Northern and Southern Nigeria into the single colony of Nigeria. It is now announced that a capital of the newly constituted colony is to be built at Yaba, far in the interior, and at an elevation of over 2,000 feet. Although Yaba is not shown on any map to which we have access, it is evidently in the immediate vicinity of Zunguru, the present capital of Northern Nigeria, as it is described as being near the point where the railway crosses the Kaduna River. The climate is said to be dry, with comparatively cool nights during the greater part of the year.

Rescue of Fishes from Overflowed Lands.—One of the many interesting activities of the Bureau of Fisheries is the rescue of fishes from the temporary lakes and pools formed when the Mississippi River and its tributaries subside after the annual freshets. During the fiscal year 1914 about 2,500,000 fish of all species were saved, this number being about three times the collection of the previous year. All of these fishes would have perished from the drying or freezing of the ponds. Most of them were returned to the main streams, but certain species were used for pond-cultural operations and for stocking waters in other parts of the country.

Valuable Gifts to Public Institutions.—The will of Mrs. Henry Draper, widow of the noted astronomer and formerly professor of astronomy at Harvard College, which has recently been filed, has greatly benefited a number of public institutions. To Harvard University is given $150,000, to be called the Henry Draper Memorial Fund, the income of which is to be used in connection with the photographic work of the Draper Memorial. The university also gets all of the scientific apparatus that belonged to Professor or Mrs. Draper, and all of their photographic plates relating to astronomical subjects. The New York Public Library receives a bequest of $400,000, with a residuary bequest of $200,000 additional, and many articles of artistic, historical and scientific value are divided between the library, the American Museum of Natural History and the Metropolitan Museum. Bequests of $25,000 each are given to the Smithsonian Institution, the National Academy of Sciences, the Surgical Research Hospital of the New York University and a number of other institutions.

Swimming Doves.—A curious instance is reported by a correspondent of the excellent Dutch natural history magazine *De Levende Natuur*, of doves acquiring the alien art of swimming. The birds in question were ordinary domestic blue pigeons living in a dovecote beside his dwelling house near the water. "A few months ago," he says, "during a fight, a dove fell into the water and was rescued by human hands with some difficulty. Since that the doves are more familiar with the water, and yesterday I saw two sailing around on it like gulls. Tempted, apparently, by pieces of bread lying in the water, they had learned the art of swimming. When they had had enough of their bath they flew quietly out of the water." The writer, Mr. Noorduyn, insists there was no possibility of mistake as the birds were only 12 meters distant and his wife and daughter saw them also, while sitting at an open window, adding that he can tell a dove from a gull at 50 meters distance when sitting still and at 200 meters when flying.

Sleeping Sickness—Previous tentative statements in scientific literature as to the important differences between the so-called sleeping sickness of Nyasaland and Rhodesia on the one hand and that of Uganda on the other are fully confirmed by a recent report of the committee appointed by the British government to consider various questions connected with trypanosome infection and especially the advisability of destroying wild animals on a large scale as a means of checking the diseases of this class. The sleeping sickness of Nyasaland and Rhodesia is due to *Trypanosoma rhodesiense*, which is carried by the species of tsetse fly called *Glossina morsitans*; this disease is relatively uncommon among the native population and is not increasing, and there is no likelihood of its becoming epidemic. On the other hand, the form of sleeping sickness which has caused an enormous loss of life among the natives of Uganda is due to infection by *Trypanosoma gambiense*, introduced from the west coast of Africa by way of the Congo. It is transmitted by the tsetse fly known as *Glossina palpalis*. In this case man forms the most important reservoir for the disease, and wild animals apparently play a very small part in spreading it, though they may become infected. Domestic animals are a somewhat more active agency in spreading infection. The committee believes that game destruction in Uganda would probably have little effect on the disease, and that efforts should be concentrated on the extermination of the flies.

Automobile

New Cyclecar Has Five-cylinder Rotary Motor.—Rotary motors have not been very successful in the automobile field, although they have proved efficient in aeroplanes. An exceedingly interesting motor of the rotary type is to form the power plant of a new cyclecar to be shown at the forthcoming Chicago automobile exhibition. The motor has 5 cylinders, and develops 12 horse-power at 1,400 revolutions per minute. It is said to be practically vibrationless, a demonstrating model being held on the knees of a workman while running at top speed.

Carl Benz Celebrates 70th Birthday.—Carl Benz, who with Gottlieb Daimler is usually considered the pioneer of the gasoline automobile, has just celebrated his 70th birthday. The marvelous growth of the automobile industry and the splendid work performed by the motor car in the present war were due in no small degree to Benz and his earliest "contraptions." His first car ran in 1885, while he filed a patent on it in January of 1886. Daimler invented independently a motor bicycle, which he completed in the fall of 1885. Neither of the two men knew of the other's work.

Does Weight Increase Tire Pressure?—That the pressure in an automobile tire, fully pumped up, remains practically the same whether the car is resting on the tires or is jacked up is the discovery made by one of the large rubber companies in an endeavor to solve some question of "caring for tires while the car is laid up." It was found by means of special gauges that in an ordinary sized tire, which shows a pressure of 80 pounds while the car is jacked up, it will show 80.4 pounds with the weight of the car resting on the tires. The cubic contents are compressed by "flattening" from 900 cubic inches to 896 cubic inches.

More Eight-cylinder Motors Announced.—A veritable craze for 8-cylinder motors appears to have struck the public, if one would judge from the avalanche of 8-cylinder cars already announced and known to be "in the works." No less than fourteen were shown at the Chicago Automobile Show and several more manufacturers of motors have announced their intention of entering the field. There are grave doubts in the minds of many people in the industry whether or not this 8-cylinder "craze" will last. The ignition difficulties, especially in case of an interruption of current to the spark plugs, require expert diagnosis when befalling a complicated 8-cylinder machine with its multiplication of wiring.

Twelve-cylinder Cars Coming.—Although no definite announcements have been made as yet, and probably will not be made for a few weeks, it is well known that several makers contemplate bringing out a 12-cylinder model next year. The significant hint was given at an automobile dealers' dinner recently, in which it was stated that "if the public demanded a 12-cylinder car" this company was prepared to furnish it. The flexibility obtained with a many-cylindered motor is an inducement to many motorists to put up with many of its drawbacks and complexities. At the present time there is but a single 12-cylinder car made, the racing model of the "Sunbeam," a British make, which took part in the last Decoration Day races at Indianapolis.

California has New Horse-power Formula.—California motorists are up in arms over the new horse-power formula that is to be used in determining the power of their cars, for registration fees. The present so-called A. L. A. M. formula, in which the bore of the cylinder alone is taken into consideration, is of little practical value at the present time of long-stroke, small bore, high speed engines, and a motor rated at 18 or 20 according to this formula, would in reality develop more nearly 40 horse-power. The new California formula is as follows: $HP = 0.224\ nD\ (D\ L)$, in which n is the number of cylinders, D the bore and L the stroke in inches. In connection with this raising of the horse-power, for higher license fees, it may be stated here that not one motorist out of a thousand gets the actual maximum horse-power out of his car in ordinary driving; the low A. L. A. M. formula expresses about the power actually produced by the motor of an ordinary car on ordinary roads in the hands of the average driver.

Portable Repair Shops for the War.—So many motor vehicles are being utilized in the conduct of the war, and the service is so arduous, that it has been found necessary to provide some means for quick repairs, without the necessity of sending the car a long distance to some base far in the rear. To meet this demand several manufacturers in England have turned out traveling repair shops that can work right up to the front, and have done most valuable work in rescuing trucks that have met with some slight accident which temporarily put them out of action, and which in many cases would have resulted in their abandonment. A typical shop of this kind has a 3 horse-power gasoline engine which drives a dynamo that supplies lights for working at night, and also for a grinder and a portable drill. It also furnishes power for a 6-inch lathe that is provided with milling and other attachments, as well as screw cutting. The outfit includes a bench with a good vise, an anvil, forge and extensive assortment of tools, supplies and materials.

Astronomy

A Belgian Astronomical Journal, viz., the *Gazette astronomique*, heretofore published monthly in Antwerp by the Société d'astronomie d'Anvers, will be published in London during the rest of the war, if efforts now being made to secure the necessary funds should prove successful.

Proposed Solar Observatory in Kashmir.—The government of India, which already maintains a solar physics observatory at Kodaikánal, near Madras, is now considering the plan of establishing one in the lofty valley of Kashmir. Mr. J. Evershed, director of the present observatory, spent several months in Kashmir, beginning April, 1914, and made a thorough test of the conditions for both visual and photographic observations. The results appear to show that Kashmir is a remarkably favorable location for solar observations, the atmospheric conditions being much better than at Kodaikánal.

The Total Light of the Stars.—Many estimates have been published on this subject. Newcomb estimated the light of all the stars down to the 9½ magnitude to be equal to that of 240 first magnitude stars, while Young estimated that the light from the stars of all magnitudes in both hemispheres might equal that of 3,000 first magnitude stars. The latest estimate, recently published by S. Chapman, is based upon the counts of stars on photographic plates, and is stated to be the equivalent of 690 stars of the first magnitude, according to the photographic standard, or from 900 to 1,000 first magnitude stars on the visual scale.

The Observer's Handbook of the Royal Astronomical Society of Canada has recently been issued for 1915, which is its seventh year of publication. This useful little manual is especially suited to the needs of amateur astronomers and is not so well known as it should be in the United States. Besides the ordinary ephemerides and almanac features, there are popularly written accounts of the astronomical sky for each month of the year, a series of outline star maps, descriptions of the constellations, with lists of celestial objects of interest to the owners of small telescopes, a section on meteors, and a variety of astronomical statistics, which are always kept well up to date. The society has its headquarters at 198 College Street, Toronto.

Small Grants for Astronomical Research.—"What use would you make of a grant for astronomical research of $1,000 a year for 5 years?" Prof. Edward C. Pickering has put this question to twelve prominent American astronomers, with the intention, after determining what needs can be met by such modest grants, of making an effort to secure the money. The answers to his question are summarized in *Science*, and it is interesting to find that it would take very little money—less, it may be noted, than the value of the ammunition used by a big siege-gun in the course of a day's firing—to put through several astronomical undertakings of great importance. Most of the astronomers questioned state that they would use all or a large part of the proposed grant in hiring assistants.

A Brilliant Fireball.—In Nature an interesting letter from Mr. W. F. Denning is published. He writes: "On November 11th, at 11.13 P. M., a magnificent meteor was seen from near Purley, Surrey, Stowmarket, Hornsey and other places. It looked like an unusually large ball from a Roman candle firework, and moved very slowly in the northeast sky, occupying about 6 seconds in an extended course. It was not a Leonid, but apparently from a radiant near α Lyrae in the northwest. The meteor illumined the sky vividly for several seconds, and was evidently rather near the earth's surface. From a preliminary discussion of the few descriptions already to hand it appears that the object fell from a height of 50 to 32 miles, and its velocity was about 11 miles a second. There was no known shower near Vega at the middle of November, but certain large meteors appear to be isolated. Some of the observers supposed it to have been one of the regular November meteors, but its direction was different and its speed altogether two slow for it to have been a Leonid.

Colors of Stars.—Prof. Barnard has investigated the colors of the stars forming the cluster M 13 in Hercules. When stars are too faint to be examined spectroscopically, an idea of their type of spectrum may be obtained from their observed color. In cases where the stars are so faint that they exhibit no color at all the photographic plate is called in. In the case of star clusters it is of great value to know whether the component stars are all of one spectral type or whether they show representatives of all types. In Prof. Barnard's investigation on the above-mentioned cluster the stars are practically divided into two color classes, blue stars and yellow stars, and this has been done by comparing two photographs of the same cluster taken under two conditions. One photograph, taken at the Potsdam Observatory, was taken in such optical conditions that the blue stars were relatively brighter than the yellow stars, while another photograph, taken at the Yerkes Observatory, was arranged so that the reverse should be the case. Prof. Barnard concludes that in this cluster there exist stars of extremely different types, and hence by inference, that there are stars of all the different spectral types.

The Periscope—How It Is Constructed and Manipulated

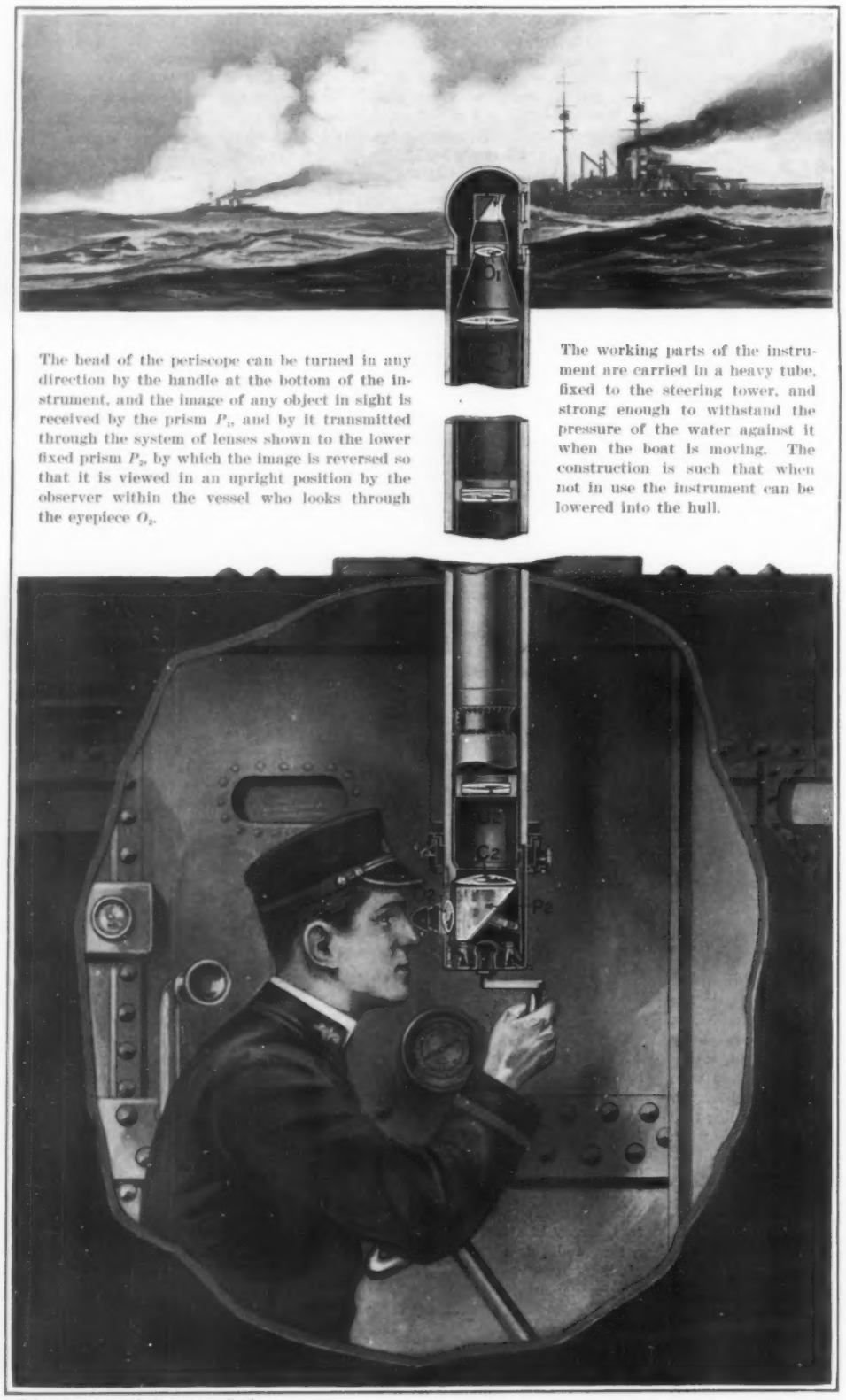
The Searching Eye of the Submarine

THE mysterious and sensational performances of the foreign submarines have excited much wonderment in regard to how this stealthy scourge of the sea finds its way about under water, and locates its prey with such deadly certainty; and although pictures of this vessel, with its mast-like spying tube, the periscope, extending up from below to just above the surface of the water, are familiar, few realize the vital importance of this contrivance or the slow development that it has passed through before becoming the efficient piece of apparatus that it is today, and which is so essential to the successful prosecution of underwater attack. The power of the submarine is vested in its invisibility; but while the submarine is hidden from the enemy it must itself be able to see everything that is going on in order to solve its problems of offense and escape.

Something of the history of the periscope was told recently in the year book of the Schiffsbautechnischen Gesellschaft by Dr. Weichert, director of the Goertz optical works, from which publication the following facts are obtained. It is stated that the oldest known device for viewing objects from a concealed position was by means of a telescope with a doubly bent tube, which device was invented by Helvelius in the seventeenth century, and this may be regarded as the progenitor of the periscope. It may be noted that at long range this instrument gave a field almost too small for practical purposes.

The simplest sighting apparatus for submarines was invented in 1854, for it must be remembered that the work of experimenting on submarine vessels has been going on for a hundred and fifty years or more. This apparatus consisted only of a vertical tube that had a plane mirror set at each end at an inclination of 45 degrees from the perpendicular, and it contained the fundamental principle involved. In 1872 totally reflecting prisms were substituted for the reflecting mirrors, but in both of these forms it was necessary to use very short and wide tubes in order to cover a sufficiently wide field of view for working purposes.

The next step in the evolution of the periscope was to employ a system of lenses in connection with the prisms; and this construction is shown in the illustration, which, however, is of a later and much improved pattern. Following out the optical development of the instrument at this point, the question of the reversal of the image is provided for now by means of an "erecting prism," which is located near the lower end of the apparatus. As shown in the picture the part of the instrument tube that carries this erecting prism is connected by means of gears with the rotating top of the instrument, that carries the upper prism and the objective, in such a manner that the erecting prism turns with half the angular velocity of the top, which compensates for the difference of azimuth between the rotating upper prism and the lower fixed prism. As its name indicates this erecting prism reverses the image as it is projected through the instrument, and presents it to the observer in its natural position. In the earlier forms the instrument was in the form of a single long tube, and in order to allow it to be raised and lowered, and also turned in different directions, it was fitted in a watertight stuffing box in the top of the steering tower; but it was found that the pressure of the water against the tube, when the vessel was moving, bent the tube backward to some extent and caused it to bind so tightly in the stuffing box that it was very difficult to turn it in order to make observations through any considerable angle; so an improved construction was devised in which the periscope tube proper was contained within a heavier fixed protecting tube or sheath within which the periscope turned. Further improvements resulted in a construction in which only the head of the instrument, carrying the upper prism, is revolved, the connection with the erecting prism below being retained.



The head of the periscope can be turned in any direction by the handle at the bottom of the instrument, and the image of any object in sight is received by the prism P_1, and by it transmitted through the system of lenses shown to the lower fixed prism P_2, by which the image is reversed so that it is viewed in an upright position by the observer within the vessel who looks through the eyepiece O_2.

The working parts of the instrument are carried in a heavy tube, fixed to the steering tower, and strong enough to withstand the pressure of the water against it when the boat is moving. The construction is such that when not in use the instrument can be lowered into the hull.

Redrawn for the *Scientific American* from *Umschau*.

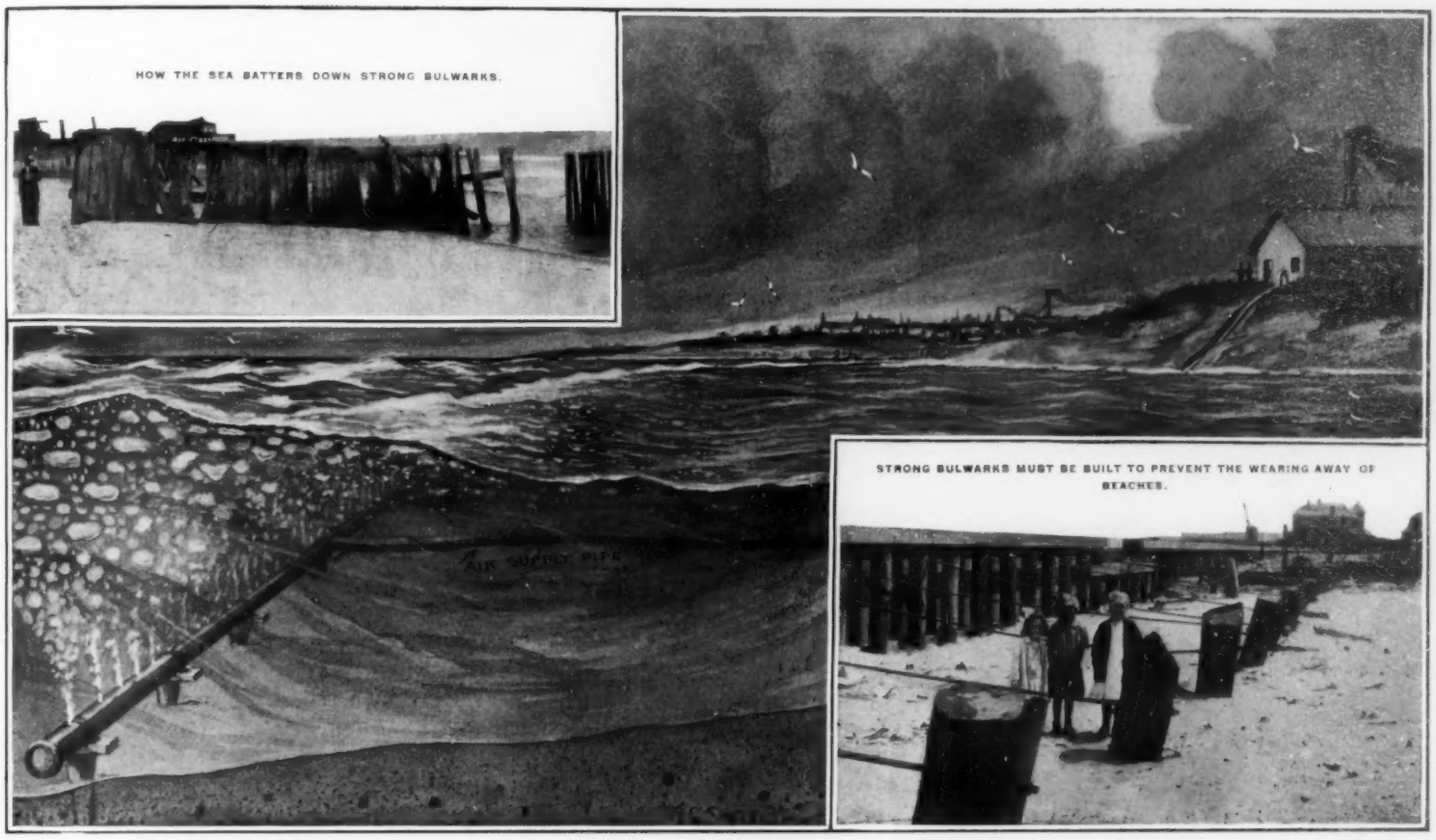
The periscope. The eye of the submarine.

To enable the vessel to be steered by the observations made by the periscope the officer in charge must have some means of knowing the exact relation of the line of sight of the instrument with the axis of the craft, and various devices have been employed for the purpose. In the earlier models this was accomplished by a mark on the tube and a graduated circle inscribed on the deck, and also by a second graduated circle and index inside the tube, and visible to the observer. A later system, adopted when the lower part of the tube is fixed, and the upper part movable, makes use of two glass plates within the tube. One of these plates is inscribed with a graduated circle and is attached to the fixed lower part of the tube, while the other plate bears an index mark and turns with the upper part of the tube.

The magnifying power usually found in these instruments is 1.5, but by the employment of special devices a power of from 5 to 6 magnifications can be secured temporarily. A more recent instrument contains a novel and valuable improvement that gives a sharp magnified image of the object sighted, surrounded by a view of the entire horizon on a smaller scale. This is accomplished by means of an annular lens that is located over the objective. Lenses of this sort were first employed in topographical work by Col. Mangin of the French army. Long continued observation with a periscope, using but a single eye, becomes fatiguing, and considerable relief can be secured by adjusting the instrument to throw the image onto a ground glass screen, where it can be viewed comfortably; but this plan can only be adopted in very clear weather, and even then the grain of the glass screen is liable to obscure distant objects.

The very latest designs have a compass, and a telemeter scale, by means of which the distance of the object can be determined, ingeniously combined with the periscope.

The development of the periscope has made the submarine practical, and indeed it is this very question of directing the movements of the vessel when under water that has been responsible for much of the delay that has occurred in the successful development of the submarine. That the problem has been quite successfully solved is apparent from recent performances in foreign waters, for it has been demonstrated that by the aid of the latest directional instruments the boat can dive below the surface when beyond the sight of an enemy, and easily find its way into the midst of hostile fleets, or into crowded harbors.


HOW THE SEA BATTERS DOWN STRONG BULWARKS.
AIR SUPPLY PIPE
STRONG BULWARKS MUST BE BUILT TO PREVENT THE WEARING AWAY OF BEACHES.

By running a pipe out from the beach and blowing compressed air through it, wave action can be broken up and beaches saved.

Fighting the Sea With Compressed Air

By Robert G. Skerrett

SOME parts of our Atlantic sea coast are in grave danger because of the erosive action of storm-tossed seas. The beaches of New Jersey have suffered especially in this way, and the Federal Government is now studying the situation with an eye to evolving some sort of effective defense for the most exposed stretches of that littoral.

Wooden jetties and wooden bulkheads have been swept away time after time, and many thousands of dollars have been sacrificed in the building of ineffectual barriers. This situation inspired Mr. Philip Brasher, an engineer by profession, to devise a decidedly novel method of battling with the storm seas. In his invention again we see compressed air in a new service, for such is the medium that Mr. Brasher utilizes. He has aimed to sap the billows of their strength by assaulting them from below and from a point where his apparatus need not fear retaliation.

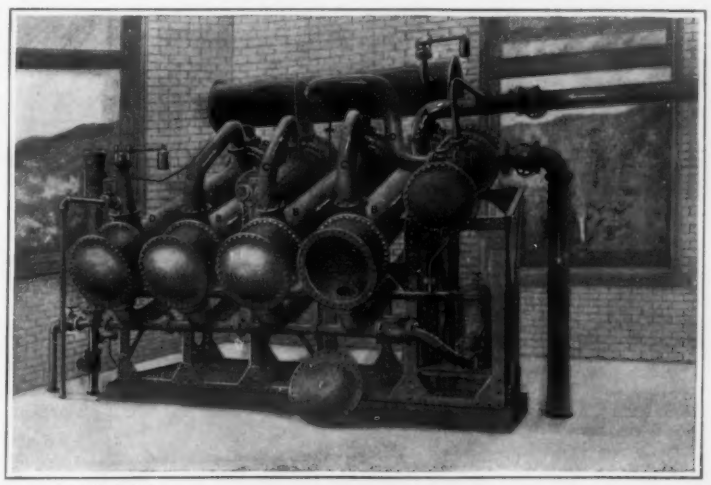
The surging sea is a grave menace only when it is about to curl over and break. At that moment, it undergoes a metamorphosis, "the oscillatory wave—one whose particles merely oscillate—becomes one whose particles travel along in a certain direction." Then it is that the entire mass, possibly representing many tons, instead of vibrating, advances bodily with the destructive momentum represented by such a bulk moving with speed. The shelving shore interferes with the vibratory translation and changes the rolling billows of the deep into the violent breakers that sweep up upon the slanting beach. As Mr. Brasher has reasoned it out, it would be possible to destroy the breakers by the theoretically simple procedure of disturbing the rhythm of the vibrating particles of water which transmit from one to the other the wave-making impulse. In other words, he would blanket or arrest this action by setting in motion a flow of particles directly across the path of the oncoming undulations, and thus interpose a barrier to further transmission of wave motion. Indeed, it might be better expressed as a gap of air bubbles supplanting the water particles normally present—a gap that would effectually bar further rhythmic oscillations.

In proof of this, it has been remarked in a well-known work on physics, that compressed air escaping to the surface of the river, during tunneling operations under the Hudson, created "a complete elevation of the water directly above the escaping columns and a tremendous disturbance of irregular bubbles. Waves which impinged on this disturbed area, collapsed like balloons which had been pricked with pins." Mr. Brasher has sought to improve upon this accidental action by distributing and controlling scientifically his flow of air. Forming, as he calls it, an "air breakwater."

To this end, he lays a long line of perforated 4-inch pipe on the water bed of the area to be protected and places this main at right angles to the sweep of the oncoming waves. A connecting branch, giving the system a T-shape, reaches shoreward, where it meets an air compressor of suitable capacity. According to Mr. Brasher, his air breakwater will make possible a number of marine operations which would either be seriously hampered or completely halted otherwise. "Dredgers can be kept working in the most exposed places during the roughest weather. The erection of permanent breakwaters, piers, lighthouses, and dams may be continued steadily, no matter what the weather conditions. Half-completed structures may be protected until completed. Lightships can ride out the roughest gale in an artificial lagoon of calm sea. Stranded vessels can be protected from the pounding of the waves until refloated." And, logically, exposed shore fronts can be similarly safeguarded against the sweep of stormy seas.

In view of what most of us know about the damaging and the well-nigh irresistible energy of tempest-bred waves, skepticism is not unpardonable, but those interested in this ingenious system declare that "the worth of the Brasher air breakwater is not a matter of conjecture. It has been proved practical and immensely valuable by actual tests. Mr. Moon, superintendent of the quarry at Crutch Island, Maine, where a trial plant was located, reports that on the day of the trial waves were rolling in so high that the spray was flying over the tops of the trees along the shore. Fifteen minutes after he turned on the air, Mr. Moon said he could paddle around in a canoe in the smooth water that the air breakwater furnished."

The question is, can Mr. Brasher's invention be applied to the New Jersey coast upon a scale ample enough to shield the areas that now suffer the most when a southeast storm blows? Will it be possible to furnish such a defense at a reasonable cost? To be effective there must be an abundance of air available, and air compressors of sufficient capacity to provide the needful supply would unquestionably demand a very heavy outlay. Finally, we ask, can the scale of the experimental plant at Crutch Island be taken as a guide for the application of this system to the more extended and possibly the more exacting situation to be met on the New Jersey coast? If it can, Mr. Brasher has opened the way for notable work in a number of coastal and salvage problems.



By courtesy of *Prometheus*.

Fig. 1.—Steam boiler heated by volcanic steam.

Using Volcanic Steam for the Production of Electrical Energy

THE little city of Volterra, in northern Tuscany, is celebrated for its great salt wells and its extensive gypsum, marble and alabaster quarries. From Volterra a 90 minutes' automobile journey through a picturesque mountain region brings the traveler to Lardarello, the headquarters of the Societa Boracifera di Lardarello. The houses and the factory buildings are half hidden by clouds of sulphurous vapors, and the air smells strongly of hydrogen sulphide for miles around the village. This volcanic region contains many hot springs, *lagoni*, and numerous jets of steam, *soffioni*, which issue from holes and crevices at pressures up to 3.5 atmospheres and temperatures up to 400 deg. Cent. (752 deg. Fahr). Both the springs and the *soffioni* are impregnated with boric acid, which has been extracted from them, very easily and profitably, for a hundred years. It appears probable, however, that the heat contained in the *soffioni* will soon become more valuable than the boric acid.

The production of boric acid from the seventy natural springs and over 300 borings operated by the company is still carried on in a very simple manner. The water is conducted into large reservoirs, lined with masonry, where it is heated by injecting steam from the *soffioni*. The boric acid in the steam is thus added to that of the spring water. After 24 hours' heating and evaporation the water contains ½ per cent of boric acid. The steam is then cut off, the water is allowed to

settle and is then allowed to flow out slowly through a series of shallow leaden pans, which form a flight of steps about 8 feet wide and 400 feet long. The pans are heated below by *soffioni* steam—the only source of heat known in Lardarello. They are sheltered from rain by a primitive roof, but, as the air has free access at the sides, evaporation is so rapid that the solution leaves the last pan in crystallizable condition. After this solution has deposited its sediment in a steam-heated clarifying basin it is drawn off into lead-lined wooden vats, where it cools and crystallizes.

The boric acid thus obtained is not chemically pure. It contains ammonium sulphate and other impurities. Some of it is shipped in the crude state to borax factories. The remainder is purified by dissolving in hot water, adding nitric acid, expressing the mother liquor from the crystals formed on cooling, redissolving and recrystallizing. The pure crystals are dried, ground, sifted, and packed in boxes and casks, which are carried on Tuscan carts to the railway station at Volterra.

The steam from the *soffioni* serves not only as a source of boric acid and a source of heat for evaporating the spring water and drying the crystals, but also as a source of power for all the machinery. It is employed to operate low-pressure cylinder engines which drive the grinding mills, sifting machines, conveyers and hoists, the woodworking machinery for making boxes and casks, and a machine for rolling sheet lead, chiefly from old material. Another engine drives a dynamo which furnishes electric light for the factory buildings, the houses of the officials and workmen, and the castle of the Count of Lardarello. Finally, the natural steam is used exclusively for heating and cooking in Lardarello, which imports no coal or other fuel.

According to an article in *Prometheus*, from which we glean our facts, the steam is employed in a very wasteful fashion in the small non-condensing engines, some of which are of venerable age and leak atrociously, owing to the attrition of the mineral particles which the steam carries with it from the earth. But the steam costs nothing, and as it has been flowing in ever-increasing volume for a century, there is no fear of the supply's failing. "When we need steam we thrust a cane into the ground," the author of *Prometheus*' article was told. The problem is not quite as simple as this, but a copious outflow of steam can always be obtained by boring to a depth of 30 or 40 feet.

This inexhaustible supply of steam has recently led the company to utilize it on a larger scale for the production of electric energy, for which there is an extensive market in the nearby cities of Volterra, Siena and Livorno (Legborn). For this purpose the low-pressure turbine, which has been developed so successfully in the past few years, seemed peculiarly appropriate. The natural steam, however, contains, in addition to boric acid and ammonia, from 4 to 5 per cent of carbon dioxide and smaller quantities of hydrogen and hydrogen sulphide. A low-pressure turbine using this steam would work with a poor vacuum and, therefore, very uneconomically, and it would also be rapidly destroyed by grit and other impurities. It was decided, therefore, to employ the natural steam as a source of heat for the production of pure steam for the turbines.

In order to test the feasibility of this plan the inclined water-tube boiler shown in Fig. 1 was constructed. A longitudinal vertical section of one of the four parts is shown in Fig. 2. The *soffioni* steam, entering at *A*, flows downward between the water-tubes, outward at *B*, and through the pipe *C* to the next section of the boiler. The water condensed from the natural steam escapes through an outlet at the lowest part of the bundle of tubes, while the gaseous impurities accompany the steam through the four sections of the boiler and are discharged into the atmosphere from the fourth section, with the uncondensed remnant of the steam, which has given up a large part of its heat to the pure water in the tubes. The feed water is pumped into the tubes through the inlet *F* and is kept at the level *a-b* by the regulator *E*. The water in the tubes is vaporized very rapidly and the mixture of steam and water is expelled violently from the upper ends of the tubes into the chamber *G*. The impact of the mixture upon the front wall of this chamber separates the steam from the water. The steam rises into the tubular steam chest *M*, which crosses all four sections of the boiler, while the water flows back through the return pipe below and rejoins the circulation in the tubes, as the arrows indicate. As the steam still contains some water it is not allowed to enter the turbine directly from the steam chest *M*, but is passed through a drying chamber (*S*, Fig. 1) very similar in construction to a boiler-section, where the remaining water is vaporized by the heat of natural steam.

The boiler has a total heating surface of nearly 1,100 square feet. It uses about 6,600 pounds of natural steam at 3.5 atmospheres pressure, and produces about 5,500 pounds of pure steam at 4 atmospheres (total) pressure per hour. The pure steam drives a 180-kilowatt low-pressure turbine, and is then condensed and returned, as feed water, to the boiler.

The results obtained with this experimental plant were so satisfactory that the company, after securing extensive contracts for furnishing current, decided to install three low-pressure turbines of 3,000 kilowatts power and 3,000 revolutions per minute. These turbines and the boilers required to operate them are now in process of construction, and a large area about Lardarello will soon be supplied with electric energy obtained from volcanic steam.

Do You See the Point?

By Dr. Leonard Keene Hirshberg, A.B., M.A., M.D. (Johns Hopkins)

YOUR friend walks across the street. He slips upon a banana peel. He does not fall, but wobbles about perilously, juggling his topbat with one wild hand and the air with his other. You and everybody who witnesses his awkward embarrassment laugh aloud. Why? Have you ever stopped to consider it?

Frank Tinny, the great black-face comedian, and Julius Rannen, the side-splitting monologist, appear before the footlights, the one in absurdly informal regimentals, the other in a dignified dinner jacket. The whole audience sets its face in a smile or guffaws noisily before either has said a word. Do you know why?

A solemn wedding ceremony is in the process of being performed. The congregation are as silent as a desert. The turning of the page of the Bible by the clergyman sounds like cannonading by an 18-inch gun. Suddenly the officiating minister lays his hands upon the kneeling couple and absent-mindedly reads, "O Lord, forgive them, for they know not what they do." A veritable pandemonium of half-suppressed merriment follows. Yet why is this pathetic mistake funny?

It is Christmas Eve. The snow falls and shoppers all hurry through the biting cold. Only a half-starved, half-naked ragamuffin lingers yearningly in the Arctic outdoors before a frosty bow-window in which are toys

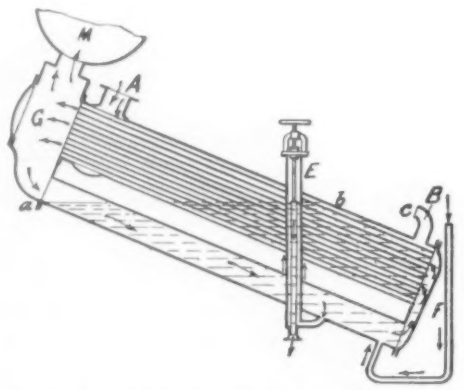


Fig. 2.—Longitudinal section of one of the boiler sections.

and Santa Claus. You see the longing and the poverty in his wan face. You do not know whether to cry or to smile. You may easily remind yourself of many other situations which have occurred to you that brought forth tears of laughter or tears of sympathy, you are not certain which.

Prof. Sigmund Freud, Prof. Henri Bergson, and Prof. John B. Watson of the Johns Hopkins University, as well as a number of other observers and experimenters, believe now, at last, that they "see the point" in the mysterious manifestations of merriment which all healthy persons enjoy. Everybody in every land boasts of his sense of humor, and no Englishman will admit that a modern major operation by Dr. Harvy Cushion, the brain surgeon, is necessary to get a joke into his head. Yet most Britons will tell you seriously that "some statements in George Bernard Shaw and Rabelais are incredible."

Such skeptics as Dr. Knight Dunlap, associate professor of experimental psychology at Johns Hopkins, say shyly that the men who have solved the *modus operandi* of human laughter perpetuated a perennial joke in their writings. Indeed, it is only owing to a lack of humor in philosophers that they take the works of Bergson, Lovejoy, Descartes, Kant, Hume, Hegel, and even Aristotle seriously.

It is according to the latest researches that abrupt discovery by one person, or rather the sudden feeling of vanity, of a sense of momentary supremacy, symmetry, and superiority in themselves over the individual or situation that is amusing, that causes the comedy. By habits, customs, superstitions, and prejudices most people have a standard of comparison to which all activities, behavior, and conduct must conform.

Any deviation from this normal form, if made slowly, gradually, and by things and persons that are honored and respected will pass muster without a smile. Even if a bit of behavior is done by one who is expected to do that particular thing, it will be watched and studied with attention. Thus, if a dancing master stands forth in an isolated position and performs a few strange gyrations, others round about will applaud and try to imitate him. If, however, a Methodist minister were to do exactly the same thing, not necessarily in his pulpit, but even in a dance hall, ribald laughter would be his just deserts.

A humorist always tries to destroy the logical sequence of words, events, and human behavior. The more the puritan loves symmetry, the more your merry Andrew hates it. The former bolsters up all perfection, the latter renders it ridiculous by a sudden termination of the correct proportions. The greater the contrast and unexpectedness in this artificial asymmetry, the funnier the result.

Superiority is a sensation that accompanies your recognition of an abruptly appearing inconsistency in form, word, action, or event. When Mrs. Malaprop says that the sight of the poor cat floundering about in hot grease was "heartrendering," your vanity is tickled to think that you know that the correct word is heartrending. This together with the asymmetry and inconsistency as well as contrast in the sentence, all stir your resibilities.

There is no true distinction, as some philosophic quibblers would have you believe, between wit, humor, slap-stick buffoonery, and Aristophanesian fun. All of them are based upon these same fundamental things, whereas one has to do with words. Another has to do with thoughts; while a third has to do with behavior, the fourth has to do with events.

Vanity,
Superiority,
Debasement,
Incongruity,
Asymmetry.

Sudden, emphatic contrast. It is all a mere matter of elementary addition. Even those instances of pathos that are upon the border-line of laughter and sorrow are linked closely together. For do not both of them stir you to tears? The warp of melancholy is intermingled with the woof of hilarity, and both weave a textile that covers the heart.

Nobody can have a real sense of humor who takes himself or life seriously. The first step toward the acquiring of the humor facility is to take an honest measure of your own unimportance in the world. Anthony Comstock, Emmeline Pankhurst, Barrett O'Hara, Charles F. Murphy, ex-Governor Sulzer, and Theodore Roosevelt would all have been more efficient and more true to the world and to themselves, if they were gifted with a better appreciation of their own plentiful lack of humor.

The Puritan conception of life, like that of vice-crusaders, suffragettes, and most crusaders, scorns all trifling with its weighty realities. Logic, symmetry, superstitions, and the human machine must never under any circumstances be interrupted from the even tenor of life's way. Neither Isaiah, the Athanasian, or any of the Old Testament contains humor, so then what right have you to laugh?

Unluckily for this type of militant morality, human nature will be forever human nature. So just as there is only one chemically pure vice-crusader in each ten thousand men, so there is only one man in ten thousand who is physically and morally able to keep his face eternally straight.

Humor, like the other sparks of the human soul, will out, and no anathema from Comstock or clergy will long suppress a Rabelair, a Swift, a Sterne, or a Judge. Jocosites are always strictly human, even when the wit is decorous. Gross incivilities, made palatable by fun, are like caviare to epicures. Your worst and most unfairly treated enemy can always be deprived of sympathy by wrapping your attack upon him in laugh-inspiring words.

If you would know, then, why a particular occurrence, phrase, situation, or bit of behavior stirs your midriff, pause calmly for a moment and honestly study your feelings. Your vanity will be given a shock, if Alexander Pope was right, when he said: "Gentle dullness ever loves a joke." This, however, is only part of the truth, for gentle wisdom and gentle education also love jokes.

To jest is human; to be serious, a crime!

Zoline Fuel Had "Too Much Carbon."—Zoline—the fuel that was to make motoring cheap, and that was to do all sorts of other things—is a thing of the past. At small expense a coterie of motor car manufacturers submitted the product and its inventor to a few rigid tests which proved it a failure. From a practical viewpoint the fuel would not work, because it persisted in crystallizing in cold weather, and even in moderately cool weather it would clog up the feed pipes. Chemists who have analyzed it say it has too much carbon, far more, in fact, than could be explained by the chemical constitution of the ingredients which the inventor said he used.

Government Co-operation With Our Industries—I

Why Foreign Markets are Closed to Us and How They May be Opened

IF the war will teach us the value of industrial research as an aid in the development of our industries, if it will induce manufacturers to engage technologists to devise processes for manufacturing the goods which hitherto they have purchased abroad, if it will open up foreign markets hitherto closed to us, it may prove a national benefaction. But unless the economic conditions are right it may not pay to spend millions in scientific investigation and in building factories. Economic conditions are, in part, controlled by governments, and it is the purpose of this article to discover whether or not our Government is enabling American capitalists to make the most of the opportunities created by the present conflict.

Perhaps the most conspicuous example of our apparent indifference to industrial research is to be found in the chemical industry—at least the newspapers told us so.

What the Establishment of a Coal-tar Chemical Industry Means.

Since the American chemical industry has been more severely criticised than any other, we may well enter into a discussion of its difficulties, bearing in mind that they apply to a lesser degree to other manufacturing activities. There was a wild scurrying about for dyes and chemicals last August. Textile manufacturers bought all the colors that they could carry in stock, Certain chemicals, particularly some pharmaceutical products, were sold at a great advance over prices which, even in time of peace, were considered too high. The newspapers took up the question, and rather hysterically accused American chemists of incompetence. We had built up a great steel industry, a great machine tool industry, a great automobile industry. Why hadn't we built up a great chemical industry? Because Germany had a chemical monopoly, because the whole structure of modern organic industrial chemistry is German, it was thought that the German mind must be endowed with some magical power of penetration not given to the American, British, or French intellect.

The truth is that there is nothing the matter with the American intellect. We have no chemical industry and we are not likely to have one until the proper economic conditions are created by legislation. And that statement applies to other industries as well. Since the passage of anti-trust laws the prospects are gloomier than ever. The whole question has been argued back and forth in meetings of technical societies and in papers published in technical periodicals. Those who take a deeper interest in the subject should read the very detailed analysis which Dr. Bernhard C. Hesse made for the Board of Directors of the General Chemical Company, and the recommendations which the New York section of the American Chemical Society has made on the enlargement of the coal-tar chemical industry in this country. Both will be found in the *Journal of Industrial and Engineering Chemistry* for December, 1914.

As Dr. Hesse points out, the world's market in coal-tar dyes comprises about 900 distinct and different chemical substances, which are made by the aid of 300 products of transformation, themselves not dyes, often products obtained or obtainable from coal-tar by distillation, refrigeration, expression, or the like. No industry presents so many interlacing problems. Yet so thoroughly have the Germans done their work that in searching for new outlets only one unexplored field has been opened in the last ten years. In other words, all the pioneer research has been completed, and the task that remains is purely mercantile in character.

Dr. Hesse sums up the situation thus:

"Broadly speaking, all the rest of the world, outside of Germany, merely assembles intermediates purchased from Germany into finished dyes; Germany alone makes all its own intermediates; that is, Germany makes all the dye-parts and the rest of the world merely assembles these dye-parts into finished dyes. Needless to say, the one who controls the manufacture of dye-parts actually controls the manufacture of dyes.

"Where Austria, Belgium, France, Great Britain, Italy, Russia, and Switzerland singly and combined have failed, in spite of their other large chemical industries, to take away this business from Germany, the American chemist should not be blamed nor found fault with because he has not succeeded, nor should it be assumed that transplanting of the whole industry can be done at once and is a perfectly easy thing to do, as so many seem to think. The transplanting of that industry out of Germany is an undertaking properly and fitly to be described as titanic.

"Why the other countries have failed is probably due to the fact that they contributed little or nothing to the real upbuilding of the business, and to its creation, for the coal-tar dye business is a *created* business; those who aided in its creation were first in the position to reap the benefits—an advantage they have no doubt earned and deserved through the effort they expended and the risks they assumed."

This is the first of a series of articles which the SCIENTIFIC AMERICAN *intends to publish on our present industrial crisis and on the best methods of taking advantage of the commercial situation created by the war. Because Americans cannot possibly hope to succeed in entering foreign markets without first inquiring into the attitude of the Government toward industry in general, it seemed advisable to ascertain how far recent industrial legislation assists or arrests our export trade. Accordingly, this phase of the subject is taken up in the present article. The subsequent articles will indicate how far our own industries have been affected by the war, because they can no longer obtain from Europe the basic materials which they require, and how, by means of industrial research, they may render themselves independent of Europe, not only for the time being, but forever. The articles were prepared after many interviews with Governmental officials, prominent manufacturers, able lawyers, political economists, and industrial research scientists connected with private laboratories and our leading universities. For this reason the series may be regarded as a reflection of the best American political, legal, and scientific opinion on one of the most important problems which confront the American public to-day.*—EDITOR.

Why Government Co-operation is Necessary.

If this wonderful industry is to be established in this country it can only be with Governmental co-operation. An economic balance must be maintained, production must be carefully watched, wasteful competition must be checked, prices must be fixed by agreement on some products so that the whole enterprise may flourish. The slightest change from one of the operations may serve to upset this economic balance. In a word, only a trust with the power to control production and the market could establish a great coal-dye industry in America—the very piece of business machinery which is most abhorred in Washington. The huge chemical firms of Germany are knit together, more or less, in a combination which is able to dominate the markets of the world, and which exists not only with Governmental sanction and under Governmental control, but to a certain extent with Governmental encouragement. If we are to compete with Germany we must employ the same economic weapons.

The special committee appointed by the New York section of the American Chemical Society to study the chemical situation arrived at the conclusion that "alterations in our tariff law are inevitable" if we are to have a coal-tar chemical industry. The nation as a whole must bear the burden of expanding industrial chemistry in this country. Private capital can do no more than it has done. German plants cannot be valued exactly. They must be worth several hundred million dollars. Since they were built decades ago most of them have long since been paid for in profits. Couple to that financial advantage the permission to use such co-operative commercial devices as pools and selling agreements, and we need no longer wonder why, under present conditions, we are not likely to have a chemical industry comparable with that of Germany. A protective tariff would not place us altogether on a par with Germany; but it would at least make it profitable to engage in a few chemical activities.

We cite the coal-tar chemical industry because it is the most glaring example of the need of Government co-operation that we can find. The difficulties of establishing that industry are found in a lesser degree in other industries. But everywhere the German trust looms large.

Trust-ridden Germany as an Invincible Competitor.

Even in the halcyon days of great combinations the United States was never so trust-ridden as Germany. At the present time there are more than one thousand trusts, "cartels" and syndicates, covering practically every line of business. Credits, prices, packing charges, sample shipments, these and many other things are regulated by cartels and conventions. The whole system smacks of the German army. It is organized efficiency pushed to the very limit. Needless to say, the German people relish these cartels, trusts, and syndicates no more than we relished our own combinations. But the German courts have viewed this crystallization of a nation's industry rather complacently on the whole, and the government assumes an attitude of encouragement, particularly when the competition of a foreign nation is felt. We saw that in the potash controversy. On the other hand, public opinion counts for more with trust magnates in Germany than it does here. To be regarded as an oppressor is not a social distinction; to be looked up to as a successful man—and success is measured in Germany by such titles as *Kommerzienrat*, or *Geheimrat, or Excellenz*, and by other honors which the various kingdoms, duchies, and principalities would hardly dare bestow on a commercial Tiberius—counts for more than millions. That is why greed is automatically restrained.

Germany owes her marvelous world-success in large measure to these permissive trusts. The great Westphalian Coal Syndicate, which controls practically the entire output of fuel in North Germany, has given English coal owners, struggling against one another for a bare existence, a taste of what a trust, backed by a government, can accomplish. The English mine owners care little what price they can obtain, so long as they maintain a full output. But the German collieries are in a working alliance that would be considered criminal in this country under the Sherman and Clayton laws. They distribute on fair lines the burden of loss or the balance of profit with due regard to the requirements of individual collieries. English coal operators have been forced into combinations to fight the German syndicate, for the sole purpose of supporting prices at a reasonable level. Beyond that they may not go. They can never hope to do more than avert heavy loss in bad times and earn a meager profit in good times.

Similarly, the great Steel Syndicate of Germany has pushed English steel makers to the wall. It decides what is to be sold inland and on what terms, and it fixes the quantities and prices of steel to be exported. Tariffs enable its members to command the home market. Thus it is possible to export the entire German surplus production at less than cost and tax the German consumer for the loss. German common iron bars are delivered and sold in Birmingham at $5 a ton less than it costs to produce them in Midland rolling mills. All this sounds very familiar to American ears. We rather plume ourselves that we have stopped a practice neither to be emulated nor encouraged, but that same practice must be reckoned with on entering foreign markets. We foresee the time when an international agreement must be arrived at by Germany and the United States in order that a code of commercial ethics may be framed, by the terms of which both Germans and Americans must abide. But until that millennium comes we must face the fact that the German trust exists, that it has the backing of its government, and that it has the power of dumping in any market which we seek to enter tons of goods which are not only normally cheap, but which are deliberately sold at less than our cost of manufacture until we are driven from the field. Protective tariffs alone will not help our home industries. Some form of "anti-dumping clause" is necessary, the framing of which will be a severe test of legislative ingenuity.

The Futility of Half-way Measures.

How little even American business men realize the utter futility of establishing in this country industries which could not exist without permissive combinations may be seen from the report submitted last December by the special Committee on Trust Legislation to the Board of Directors of the Chamber of Commerce of the United States of America. Those who signed the report recommend the passage of a bill which would permit combinations entered into or carried on in good faith, for the sole purpose of increasing, facilitating or benefiting export trade. Such a bill would not be of much use in establishing a dyestuff industry, for example. It would be difficult indeed to imagine how the hundreds of by-products and intermediate products of the great German chemical industries could be successfully handled, both from a manufacturing and a commercial point of view, on any such basis as that proposed. The measure advocated seems intended to meet the competition which may be expected in foreign trade from a combination of buyers beyond the control of our Government—buyers who may dictate the prices at which American goods may be sold in foreign markets in the absence of authority to American manufacturers and exporters to co-operate to maintain prices abroad.

As matters now stand it is doubtful if, under the Clayton law, a group of competing American manufacturers could even engage a common selling agent to introduce their goods in foreign markets—so completely have we tied their hands.

Thanks to the Clayton law, still judicially unconstrued, our great manufacturing corporations may not legitimately use the powerful machinery of combination in their struggle for foreign recognition. A new enterprise which is to be conducted on the large scale

(Concluded on page 108.)

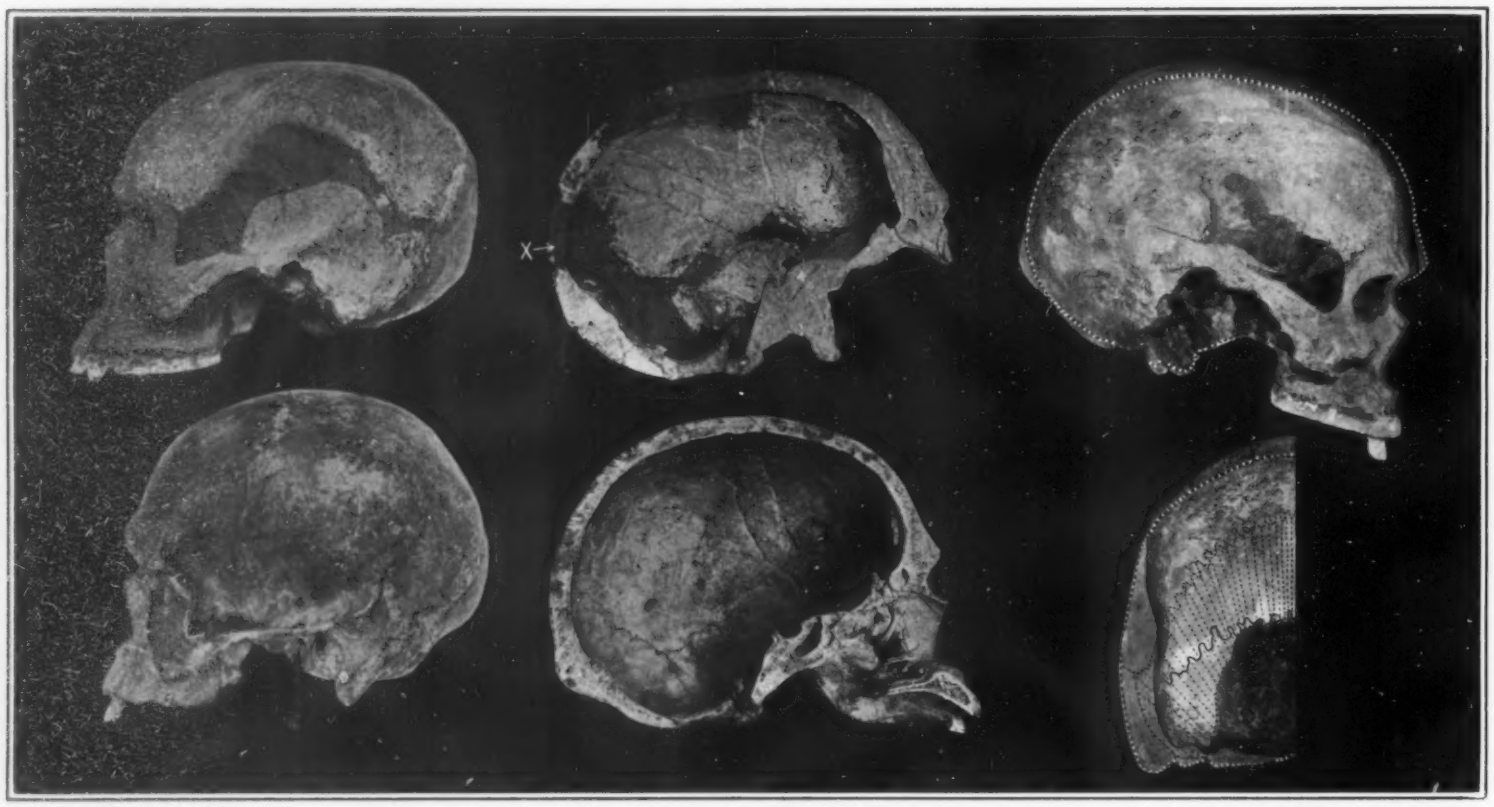


FIG. 1. (Upper).—Restoration of the Piltdown skull by W. P. Pycraft. The most conspicuous features of this aspect of the skull are the low dome, relatively slight development of the bony ridges over the eyes and the great length of the palate.

FIG. 2 (Lower).—Skull of an Australian aboriginal. In this the dome of the skull is seen to be much higher, the brow ridges larger and the palate shorter.

FIG. 3. (Upper).—Inside of the Piltdown skull, showing contact between the squamosal, or temporal bone, and the parietal, marked, and the low floor of the fore part of the brain case. The slope of this floor should be compared with that of the Australian aboriginal, shown in Fig. 4. Note the unusual thickness of the skull wall.

FIG. 4. (Lower).—Inside of skull of an Australian aboriginal, showing comparatively large brain cavity.

FIG. 5. (Upper).—Superimposed outlines of the Piltdown skull and that of an Australian aboriginal, bringing out characteristics shown in Figs. 1 and 2.

FIG. 6 (Lower).—Superimposed contours of the left half of the back of the Piltdown skull and that of the Australian aboriginal. Note the enormous width across the base of the Piltdown skull. The dark shaded areas in all the figures of the Piltdown skull represent restored portions.

Details of the Piltdown skull, and comparisons with skull of an Australian aboriginal.

Mankind in the Making

The Direct Ancestor of the Modern Man and What He Looked Like

By Prof. W. P. Pycraft, British Museum, London

THE history of mankind in the making is still far from complete, and this is especially so in regard to its early chapters. Most of what we have gleaned on this head is in the nature of inference, drawn from the rude stone weapons which have survived him, leaving no trace of their makers.

The discovery of the now famous fragments of an indubitably human skull at Piltdown, in Sussex, which was first announced at a meeting of the Geological Society of London, December 18th, 1912, was, therefore, an event of epoch-making importance, for not only was it found in association with rude stone weapons of the type known as "eoliths," and with remains of animals of older types than any hitherto associated with early man, but it displayed features more primitive, more ape-like, than any yet discovered. Quite recently a further find has been made of a crude sort of spear-head, made from the thigh-bone of an elephant. This was obtained from the same area as the skull itself, and from its highly mineralized condition there can be little doubt that this was wielded by the Piltdown man, or his contemporaries. Since the precise geological age of this skull is still a matter for debate—as to whether it is to be regarded as of very late pliocene or early pleistocene—it will be more profitable to discuss in these pages those features of the skull itself which have made it of such supreme importance as a "missing link" in the chain we are endeavoring to forge.

These bones of contention, for such they speedily became, represent the roof and back of the skull, the temporal bone, with the great triangular beam lodging the internal ear, and, externally, a part of the bony arch which runs forward to the eye, and last, but by no means least, the lower jaw, or rather the right half, containing two molar teeth. Later a relatively huge canine turned up, of which more anon.

As Dr. Smith Woodward pertinently remarks, when it is remembered that *Eoanthropus Dawsoni* and *Homo Heidelbergensis* are almost, if not absolutely, of the same geological age, we are led to the interesting conclusion that at the end of the Pliocene Epoch the representatives of man in Western Europe were already differentiated into widely divergent groups.

This skull is no less remarkable when compared with the other undoubtedly ancient human skulls, and suggests conclusions of even wider significance. The discoveries of the brain-case of that curiously ape-like man, Pithecanthropus, in Java, some years ago, and of several of the skulls of the Mousterian or Neanderthal type, have led to the assumption that early man was characterized by a low, flattened forehead, and a beetling brow, like that of adult existing apes. But the Piltdown specimen, Dr. Smith Woodward points out, is certainly the oldest typically human skull yet found, yet it has a forehead as steep as modern man, and by no means conspicuous brow-ridges. This latter fact has led to the suggestion that this skull is that of a female, and the small backward extension of the area for the masticating muscles is held to be an additional index supporting this conclusion. This, of course, may be so; but on the other hand we have to take into consideration the enormous thickness of the skull wall, which by the way goes far to account for the small size of the brain.

All the evidence goes to show then, that at least one type of man with a high forehead was already in existence in Western Europe long before Mousterian man. It is curious to remark, however, that this ape-browed man had a larger brain than the Piltdown man. This apparent discrepancy is explained by the almost inevitable conclusion that the Piltdown man is the direct ancestor of modern man, while the Mousterian or Neanderthal man was an offshoot from this stock. In regard to the base there are one or two features of quite exceptional interest. In the first place the width exceeds that of any modern skull so far measured by some 20 millimeters (Fig. 6). So wide a difference indicated either an error in the work of reconstruction or some structural peculiarity so far unsuspected. Having carefully considered the problem in the course of a restoration I had undertaken to check, as it were, the results of Dr. A. Smith Woodward, I came to the conclusion that some structural peculiarity was to be sought for, and this I speedily found in the exceptional length of the petrous bone, which proves to be no less than 10 millimeters longer than in any modern skull. Thus adding this increase of the two sides together the abnormal width was exactly accounted for. This increase has been accomplished by a curious change in the parietal region of the skull for the hinder and lower border of this region, somewhere about the level of the top of the ear, and a little behind it in the living subject, has been thrust outward. Hence the striking difference between the Piltdown and modern skulls when seen from behind, as in illustration (Fig. 5), for in the modern skull the widest part is seen to be high above the base.

The restoration which I undertook was the first to effect a reconstruction of the floor of the brain-case, and to show the position of the nerve apertures and the apertures for the blood vessels; and from the interior of this it has been possible to take a fairly accurate cast of the brain cavity, and especially of the base of the brain. In attacking this problem I may mention that this building up of the skull base formed the foundation of my restoration. This completed, the remaining portions of the skull were fitted on to it. The result was a skull differing only in minute details from the original restoration of Dr. A. Smith Woodward, which, according to some, and especially Prof. Keith, was too absurd to be seriously considered.

The most conspicuous feature of this skull, when seen from the side, is the low roof or dome and the slight development of the brow-ridges. The latter feature is brought even more forcibly home when the skull is seen from the front, or from above. This is really surprising, for these ridges in the earliest fossil, men known as the Neanderthal men, are enormously developed, recalling those of the great apes, such as the gorilla and the chimpanzee. In the Piltdown they are less conspicuous than in many savage races of to-day.

The face must have presented an extremely ape-like appearance, owing to the enormous size of the jaws. The nasal bones, however, were negroid, not ape-like. The really ape-like characters are concentrated in the lower jaw. So much so is this the case that there are some who have gone to ridiculous lengths to show that this was really that of an ape, and had nothing to do with the skull. Needless to say such opinions were expressed only by those unfamiliar with the problems of comparative anatomy, and palaeontology.

That this jaw did belong to this skull is not a matter for dispute. Its Simian features should not occasion surprise, having regard to the age of the skull, and the relatively small size of the brain. Compared with that of a modern European its most striking feature is the absence of a "chin," that is to say of the projection of its lower border, which in modern skulls protrudes

beyond the level of the cutting teeth, or "incisors." In this, however, it agrees with the jaw found some years ago at Heidelberg and known in consequence as the "Heidelberg jaw." About the human nature of this there is no doubt, for the character of the teeth renders any other interpretation impossible.

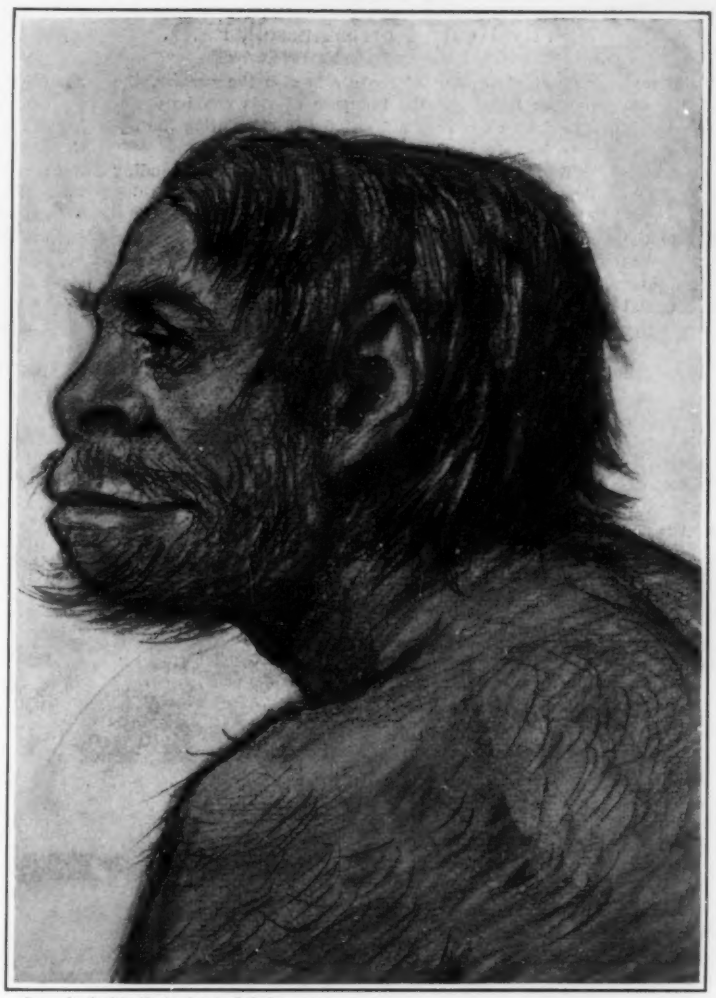
Omitting reference to many other somewhat technical details presented by the Piltdown jaw we may turn now to the teeth. The Simian, or ape-like characters of these is very striking, both in regard to their shape, and their arrangement in the jaw. As in the ape the cheek-teeth or molars, and pre-molars, are placed in a straight line one behind the other instead of in a curve, as in modern human jaws. When the jaw was first found the pre-molars, canine, or "eye-teeth" and the cutting or incisor teeth were missing. Nevertheless, Dr. Smith Woodward, in his restoration ventured to introduce a large canine. The critics scoffed, and pointed out the absurdity of such a venture. Unfortunately for them the missing tooth turned up shortly after. Attempts were then made to show that it could not have belonged to this jaw; but a more careful study of the find seems to have convinced them that they were hopelessly wrong in their pronouncements. But whether or no there can be no doubt but that it is one of the missing series. And the most wonderful thing of all is that, when this tooth came to be compared with the tooth postulated by Dr. Smith Woodward, it was found to differ only in minute details. It differs absolutely from the canine of any known ape, and no less from that of any human tooth yet found known. In some respects it recalls the canine of the milk series, which is what one would expect.

While the skull is essentially human, that is to say, it is the skull of a member of the genus Homo, though representing a man of low grade, the jaw, on the other hand, as we have already remarked, is almost that of an ape. On this account these remains must be regarded as representing a new genus of mankind which Dr. Smith Woodward has named Eoanthropus. Or to give it its full name Eoanthropus Dawsoni, in honor of Mr. Charles Dawson who discovered the first of the fragments.

The form of the roof of the skull, of the brow-ridges, and of the temporal-bone admit of no doubt as to the human character of these remains. What is known as the petrous portion of the last named bone, and the nature of the articular cavity of the lower jaw, differ only in minute points from the same areas in modern men.

No estimate as to the form of the skull, and the cranial, that is to say the brain, capacity of this skull could, of course, be made until the remains were pieced together. Toward the fulfilment of this task certain fixed points were at once available. Thus the frontal bone retained a portion of the outer border of the eye-socket, while the hinder portion of this skull-cap could be positively connected with the bones forming the back of the skull, this gave the approximate length of the cranium. There was another actual point of contact with the temporal bone and the parietal (Fig. 3). This enabled a fairly accurate estimate to be made of the height of the skull. Its width, a measurement of great importance, has formed the subject of much controversy, though as a matter of fact, there can be little room for doubt even on this head. Much depends on the correctness as to the exact position of the middle line of the skull-cap. That this has been fixed by Dr. A. Smith Woodward and Prof. Elliot Smith there can be no question, but Prof. Keith, of the Royal College of Surgeons, insists that this line has been placed too far to the left, thereby materially lessening the size of the brain case, and, as a consequence, the size of the brain, which he assures us exceeded that of modern white races of to-day. That there is absolutely no evidence to support this view we have no hesitation in saying.

The critics indeed have been singularly unfortunate, so far, in their pronouncements on this restoration. According to them, this skull is much too narrow across the roof, and much too wide across the base. As touching the roof enough, for the moment at any rate, has already been said.



Drawn for the *Scientific American* by J. Cooke.

Head of Piltdown man.

Drawn for the *Scientific American* by J. Cooke.

The Piltdown man (Eoanthropus Dawsoni).

New Lens Gives Clear Vision

WHAT was done for the photographic lens some twenty years ago has just been accomplished for the ordinary eye-glass or spectacle lens; that is, it has been corrected for astigmatism through its entire field. It is true that in the case of the photographic lens the result was accomplished by combining several layers of different kinds of glass, which could not be done with a spectacle lens; still it must be considered remarkable that when we consider how vastly the users of spectacle lenses outnumber those who require a photographic lens more effort was not made to perfect what may be called the every-day lens.

With the old style flat lenses a field of view of but 16 degrees was afforded, and if the eye was turned in its socket in any direction the image which it saw was blurred and distorted to such an extent as to be generally undistinguishable, and this made it necessary for the wearer to turn his head from one side to the other as he read a line of print. This, however, is not an operation that ever becomes really natural, and the wearer of glasses is constantly turning his eyes, and with the result that he strains the eye in endeavoring to distinguish the blurred forms seen through the side portions of the lenses. Later on an improved lens, the "toric," was introduced which, for most classes of lenses, enlarged the field to about 52 degrees, and it seemed almost as accepted that this was the limit of improvement possible. For some years, however, the work of designing an ordinary single-piece lens in which all astigmatism and distortion of the oblique rays would be eliminated has been going on at the laboratories of the Carl Zeiss works, at Jena, Germany, and as a result, Dr. Moritz von Rohr of the scientific staff has produced a spectacle lens which has been named the "Punktal" lens that gives a field of vision of 80 degrees entirely free from astigmatism. Much as wearers of glasses appreciate the annoyances and imperfections of the present lenses it will be difficult to understand the comfort and relief afforded by the new Punktal lenses until they are tried practically as practical comparison seems to be the only means of judging. The right to manufacture the new lens is held by the Bausch & Lomb Optical Company, the American associates of Carl Zeiss and among the instigators in its development.

The Detoxication of Tobacco

INNUMERABLE attempts have been made to protect smokers from the harmful effects of nicotine. So far, however, this object has not been achieved without at the same time depriving the tobacco of its aroma and taste. Recently Ambialet, a French physician, read a paper before the Medical Society of the Department of the Rhône on one of these attempts. His plan is to do away with the defects of other remedies, and it deserves publication, particularly because of its simplicity. Dr. Ambialet has found that if the ordinary coltsfoot or butterbur, which is very common in the countryside, is mixed with tobacco the harmful effects of the latter are completely eliminated. He has himself smoked daily some forty cigarettes made of this mixture, without feeling the slightest effect from the nicotine. At any rate the remedy may be worth a trial, coltsfoot leaves being perfectly harmless and cheap.

Dr. Ambialet claims that tobacco mixed with coltsfoot leaves retains its full aroma and taste, the only perceptible change, if any, being an additional flavor like that of Turkish tobacco. This added flavor should render the mixture very acceptable to most smokers.

Plastering by Machine.—A plastering machine forms the subject of patent, No. 1,100,565, to A. G. Higgins, Kansas City, Mo., assignor of one half to R. M. Havens, same place, and provides means by which cement or other plastic composition may be mixed and fed on to the surface of a trowel so it may be spread upon a wall.

The Heavens in February

Determining the Weights of Molecules and Atoms by Astronomical Observations

By Henry Norris Russell, Ph.D.

THE connection of investigations in different branches of science is often very curious. For example, no one would suppose off-hand that the weights of molecules and atoms could be determined by astronomical observations; but exactly this has just been done in a paper by Mr. Fowle of the Astrophysical Observatory of the Smithsonian Institution.

Strictly speaking, the quantity determined from the Smithsonian observations is the number of molecules in a cubic centimeter of air under standard conditions of pressure and temperature, from which the actual weight of these and other molecules can immediately be deduced. This fundamental physical constant appears in the astronomical work as a by-product of a by-product, but its determination is, nevertheless, fairly precise. The main object of the work of the Smithsonian observers has for many years been the study of the Sun's radiation. The amount of absorption of solar radiation in the Earth's atmosphere has incidentally to be determined, and the variation of this for different kinds of light gives the constant in question.

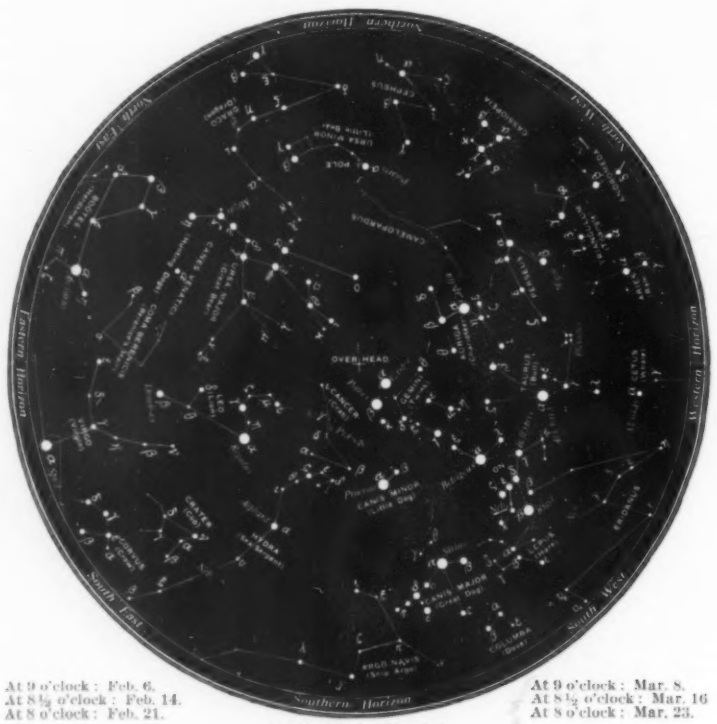
It is an easy enough matter, with modern measuring instruments, to determine how much energy is carried by a beam of sunlight of known cross-section, as we receive it at the Earth's surface. But this amount varies from day to day, with the clearness of the air, and from hour to hour, with the altitude of the Sun and the length of the path which its rays traverse in our atmosphere; and to correct for this and deduce how much energy the measuring apparatus would have received per minute if it had been situated outside our atmosphere, is a difficult problem.

If all the solar energy were carried by radiation of a single kind (of a definite wave-length) the calculation would be fairly simple. Suppose that, at noon, with the Sun at its highest in the sky, our atmosphere lets 90 per cent of the energy of the radiation get through to the Earth's surface. A second layer of air of equal thickness would transmit 90 per cent of the energy which got through the first layer. But we can actually obtain such a double layer by observing at a time (in the morning or afternoon) when the Sun is at such an altitude that its rays have to traverse twice as long a path through our atmosphere as at noon. The energy which we would receive outside the atmosphere will then be greater than that measured at noon in the same proportion in which this exceeds the amount measured at the morning observation. In practice any two observations at different altitudes of the Sun can be used, for the "air mass" along the path of the rays can always be calculated. What complicates the actual problem is that the amount of absorption, for the same thickness of air, varies very greatly for radiation of different wave-lengths. It is, therefore, necessary to split up the solar radiation by means of a spectroscope, determine the amount of energy caused by radiation of each wave-length and apply the process just sketched to each separately, adding the results at the end to get the whole solar radiation.

As an incident in this laborious but unavoidable process, it is clear that the computer will obtain values for the transmission of radiation of different wave-lengths through the Earth's atmosphere, which may easily be reduced to the amounts which would be found for rays coming vertically downward along the shortest possible path. As might be expected, the atmospheric transmission is much diminished by any perceptible haziness of the sky, and good sets of observations can only be obtained on clear days. But, even in the clearest weather, and at high mountain stations, there is a very perceptible loss of energy in passing through the air, and the percentage of loss increases steadily as the wave-length of the radiation becomes smaller. Under favorable conditions at Mount Wilson almost 99 per cent of the infra-red radiation of long wave-length gets through the air. In the green part of the spectrum the percentage transmitted drops to 90, in the violet to 80, and in the ultra-violet only a little way beyond the limit of easy visibility to 60.

In certain regions in the infra-red, the atmosphere is almost opaque to solar radition, owing to "selective absorption" by the water vapor present in it; and the general absorption of the air is also the greater, the damper it is; but the influence of this can be determined, and has been allowed for in calculating the figures just given.

There is good reason to believe that the outstanding depletion of the solar radiation on passing through dry air arises mainly, not from actual absorption of the energy, but from scattering of the radiation into other directions than that of the direct rays of the Sun. If this did not occur the sky on a clear day would be black except for whatever whitish dust-haze might appear in it. The familiar blue color, as Lord Rayleigh has shown, is a direct consequence of this scattering of light, which is produced, even in perfectly dust-free air, by the gas molecules themselves. These minute bodies act far more powerfully on radiation of short wave-lengths than on that whose waves are longer; indeed, the scattering power for violet light is ten times that for light in the extreme red. Hence, the air molecules diffuse a far larger proportion of blue and violet light than of red and yellow, and the sky looks blue. Dust particles, on the other hand, reflect light of all colors equally, so when the air is full of dust or haze and the sky is brighter than usual, the blue is mixed with white, and the sky becomes milky; while on the clearest days the sky is the deepest blue.



At 9 o'clock: Feb. 6.
At 8½ o'clock: Feb. 14.
At 8 o'clock: Feb. 21.

At 9½ o'clock: March 1.

At 9 o'clock: Mar. 8.
At 8½ o'clock: Mar. 16
At 8 o'clock: Mar. 23.

NIGHT SKY: FEBRUARY AND MARCH

The light which goes to make the sky blue is taken from the direct sunbeams, and, therefore, when the Sun is near the horizon, and the path of its rays through the air is long, very little blue light is left to get to us, and the Sun looks yellow or even red, whence the familiar sunset coloring.

We may, therefore, split up the general absorption of light by the air into two parts, one depending upon the presence of suspended particles of dust or fog, and the same for all kinds of light, the other depending on scattering of light by the molecules themselves, and varying as Rayleigh has shown, inversely as the fourth power of the wave-length. From a study of the Mount Wilson observations, Fowle concludes that the influence of dust or haze on the average clear day is practically negligible, the absorption due to this cause being but 1/200 of the amount transmitted.

This statement applies only to normal conditions. In 1912 the upper air was so full of fine volcanic dust from the great eruption of Mount Katmai in the Aleutian Islands that the observations of its transmission could not be used for the present purpose, and even in 1913, when the dust had had a year to settle, enough remained to produce an absorption of 2½ per cent of the incident radiation—fully five times the normal value.

Almost everything that is observed is due to the action of the molecules of the air. Now, according to Rayleigh's theory, there exists a fairly simple relation between the amount of this molecular scattering and the number of molecules per cubic centimeter, so that the last can be calculated, if the length of path of the light in the gas and the refractive index of the latter are known. Applying this formula to the Mount Wilson observations, Fowle concludes that the number of molecules per cubic centimeter of air, under standard conditions (barometer 76 centimeters and temperature 0 deg. Cent.) is 27 billion billion (27.04×10^{18}) with a probable error of less than one per cent. This is in practically exact agreement with the very precise value recently obtained in quite another way by Prof. Millikan of the University of Chicago, and in harmony also with that of other observers who have used absolutely different methods of investigation. Now, according to fundamental chemical principles, the number of molecules in a cubic centimeter of all gases, under the standard conditions, is the same. Moreover, it takes 11,200 cubic centimeters of hydrogen to weigh a gramme. Hence we find that in a gramme of hydrogen there are 303 thousand billions of billions of molecules and twice as many hydrogen atoms (6.05×10^{23}), and, since the relative weights of the atoms of the various elements have been determined very precisely by chemical means we are in a position to state the actual weight of a single atom or molecule of any substance of known chemical constitution.

A conclusion of more astronomical importance is that it is impossible to find clearer skies than exist at the best observing stations, unless by going to very high altitudes. More remarkable is the deduction that a ball of perfectly clear air as big as the Earth (if it could be kept of uniform density throughout) would be quite opaque. Yellowish-green light, the kind to which the human eye is most sensitive, loses 10 per cent in passing through the air above Mount Wilson (equal to about four miles of air at standard pressure and temperature).

Only 35 per cent of such light would get through 100 miles of air under standard conditions, even if the air was absolutely free from dust and haze, which evidently explains why distant mountains, even in the clearest weather, look blue, for at least two thirds of the light we get in looking at them is blue-sky-light from the air in front of them.

A thickness of 500 miles of air would transmit only 1/200th part of the incident light and one of 1,000 miles hardly 1/40,000th of it. Now a line between two points 1,000 miles apart on the Earth's surface passes at most about 31 miles below the Earth's surface—less than 1/100th of the Earth's radius.

Hence a ball of air as big as the Earth, when seen from a distance, would be entirely opaque except for a very narrow rim around the edge. A body as big as the stars would be still more so—so that, of whatever materials a star may be composed and however purely gaseous they may be, the star as a whole must be an opaque body.

The Heavens.

Our map shows at a glance what constellations are to be seen in the evening heavens—the splendid group in the southwest—Orion, the Great and Little Dogs, Gemini, Taurus, and Auriga. In the northwest are Perseus, Andromeda, and Cassiopeia; in the northeast, Ursa Major, Boötes, and Draco; in the east, Leo and Virgo; while Cancer and Hydra occupy the dull southeastern sky.

The Planets.

Mercury is evening star until the 21st, when he passes north of the Sun and becomes a morning star. During the earlier part of the month, and especially about the time of his greatest elongation on the 6th, he is admirably placed for observation, setting about 6:50 P. M., which is an hour and a half later than the Sun. On the 1st he is in conjunction with Jupiter, the two planets being little more than half a degree apart, with Mercury to the northward. Jupiter is about three times the brighter of the two, but Mercury, too, is above the first magnitude, and the two will form a very pretty picture. The two planets slowly separate until

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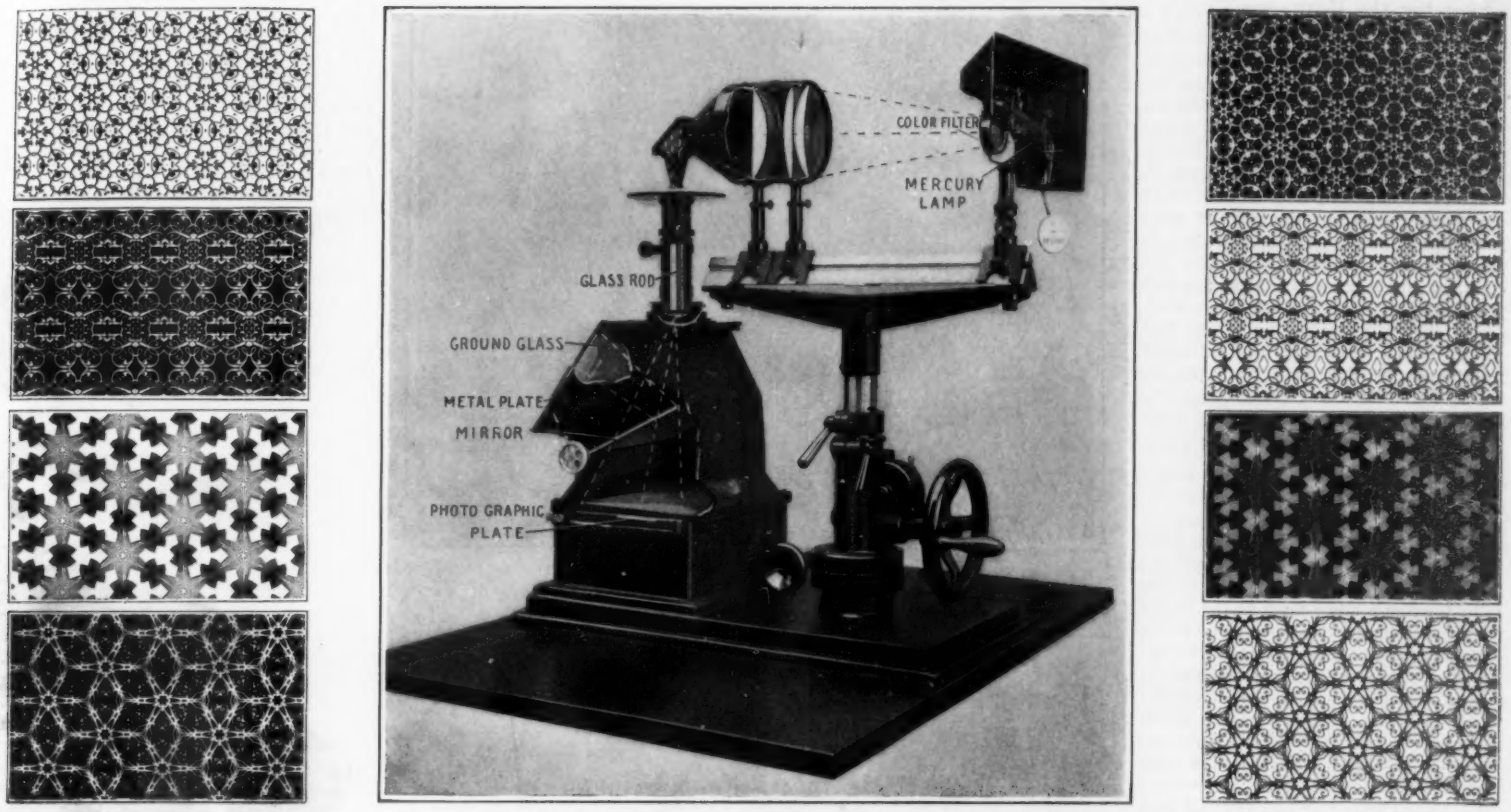


The photo-kaleidoscope is an instrument which for the first time renders it possible to fix the patterns of a kaleidoscope photographically for the use of textile and wall paper designers.

The Photo-Kaleidograph

A New Instrument That Facilitates the Designing of Artistic Patterns

By the Berlin Correspondent of the Scientific American

IT is not generally known that the kaleidoscope, so far from being a mere children's toy, has been occasionally put to practical uses, and has rendered good services in the designing of artistic patterns for weaving mills, and embroidery, tapestry, and linoleum factories. Attempts have also been made from time to time to combine the kaleidoscope with a photographic camera, though no appreciable success has been obtained in this connection.

Dr. C. Pulfrich of Jena, Germany, the well-known expert in the field of optics, has perfected an apparatus of precision which would seem to be eminently suitable for commercial purposes, yielding as it does a startling variety of striking and artistic patterns for visual inspection as well as photographic recording. This apparatus has been one of the attractions of the International Exposition of Printing, held last summer at Leipzig.

Whereas in Brewster's classical kaleidoscope, images are generated by reflection on plane mirrors, Pulfrich uses the sides of a straight, massive glass rod instead, which are ground and polished with all the accuracy obtainable in large optical works such as those of Zeiss. The angles are likewise adjusted with the utmost precision to the figures prescribed in each case. The glass rod is silvered throughout its length and is protected against damage by strips of black glass glued around its circumference. Its two ends are ground plane and polished at right angles to the length of the rod. The whole is surrounded by a metal tube, allowing only the ends to project.

The tube thus arranged is situated vertically above a horizontal photographic plate (13.18 centimeters), the objective being screwed to the lower end of the tube. The distance of the tube from the plate is so adjusted as to project a sharp kaleidoscopic picture on the latter. A set of such rods of various cross-sections is provided, which are readily exchangeable, the external diameters of all the tubes being rigorously the same. Each tube is held in position by a set-ring so adjusted as to insure a maximum definition of pictures.

The fundamental pattern from which the kaleidoscopic picture is to be composed is applied to the upper free end of the glass rod; photographs on glass are used exclusively for this purpose, thus insuring perfect contiguity between the various sections of the picture. A drop of oil having been put on the end of the rod, the glass picture, with its sensitive layer turned toward the glass rod, is slightly pressed against the latter. The rod then chooses from the picture a section of the size and shape of its cross-section, and by reflection, produces the most varied juxtapositions of this section, so as to form an endless variety of patterns.

The pattern is lighted by mercury light traversing an optical filter, thus leaving only the beams corresponding to one of the violet mercury lines for producing the kaleidoscopic pictures. A slanting plane mirror inserted between the object and slide projects the kaleidoscopic pictures on a ground glass screen and allows the patterns to be inspected and selected at will. In fact, they can thus be examined by several persons simultaneously. Whenever a pattern is thought worth recording, the mirror is thrown aside by turning it round a horizontal axis, and is kept in position by a bolt, during the time required for a photographic record (about 1 minute). The photographic view having been taken, the mirror is reduced to its original position, where it forms a light-tight inclosure for the photographic plate, while the picture reappears on the ground glass screen.

The ground side of the screen is turned outside and can be used for tracing the outlines of certain parts of a pattern.

Dr. Pulfrich's new apparatus enables an infinite variety not only of surface patterns, but of rod and band patterns and rosettes to be generated. Any photographic glass picture can be used as a basis, and kaleidoscopic pictures themselves can be employed in turn for the production of new patterns.

Each glass rod and tube can also be used separately for the inspection of kaleidoscopic pictures, the photographic objective being replaced by a lens.

The apparatus obviously admits of a number of uses in the lines of industry above referred to. It may prove desirable to supply it with an attachment for reproducing any individual picture.

"Mission Memories" Wins the Trade-mark Contest

IT will be remembered that a few weeks ago a notice appeared in the SCIENTIFIC AMERICAN stating that Mr. E. Moulié, of San Diego, had offered a prize for the best name that would serve as a trade-mark for the perfumes manufactured by him, and that the decision was to be made by Munn & Co. The time limit having expired the judges have performed their task, and have decided that the winner of the prize of twenty dollars is Amy Sebree Smyth, of San Diego, who suggested the term "Mission Memories."

The announcement aroused an unexpected amount of interest and a large number of valuable suggestions were received. The judges found their task by no means easy, both on account of the mass of material to be examined, and especially because of the conditions of the contest. In matters of this nature it is not only necessary to select euphonious words, which will be suitable from the user's point of view, but such words must also conform to the requirement of the Trade-mark Statutes, which among other things prohibit the use of a personal name, not distinctively written, words or devices merely descriptive of the goods with which they are used, or of their character or quality, or merely geographical names. There are also other technical points that must be kept in mind, so that the work of the judges in scrutinizing the very considerable list of words and terms had to be most carefully and skilfully performed. It was found that the statutory requirements were not nearly as well met as the business necessities. After careful consideration of all the conditions, both statutory and business, the term "Mission Memories" was considered to best fulfil all requirements, and the award was consequently made to it.

Lock for Bicycles

AN excellent method for locking bicycles to prevent them from being stolen is used in France, and it is one of the easiest to fit on by a clever amateur. The device is applied to that part of the frame where the front fork joins the main or upper horizontal tube of the frame. On the head of the fork is placed a stout collar, preferably riveted on to prevent turning, the collar having a projecting wing at the back so that this projects over the horizontal bar. On the bar itself is placed a second collar having a vertical projection which is pivoted to the collar. The combination makes one fixed and one movable wing which can be brought together, and a padlock is passed through holes in each. The trick of the device is that the first wing lies at a slight angle, due to the mounting of the collar, so that when locked, the front wheel no longer lies straight, but somewhat inclined, and in this way it is impossible to ride the machine.

A New Bead-string Fastener

THE clasps or fastenings ordinarily employed on strings of beads, such as the popular pearl necklaces, are objectionable not only for insecurity in many instances, but also because they make a break in the continuity, and when they slip to the front of the wearer detract from the appearance. It has been suggested that possibly some form of fastener might be devised which would include as its elements bead structures corresponding to the other units of the necklace.

Shooting the Hozugawa Rapids

FOR the price of eight yen, equivalent to $4 in our money, one may purchase the thrilling experience of shooting the rapids of the Huzu River, or Hozugawa, which flows from the highlands of Japan past the ancient capital, Kyoto. Expensive as this means of transportation is, the farmers of this particular section of the country must pay the price of eight yen per boatload to ship their produce to market. To successfully navigate the craft, such as is shown in the accompanying illustration, requires not only considerable skill, but also daring, as the fast waters of the Hozugawa are extremely treacherous and dangerous, many persons having lost their lives there.

Shooting the Hozugawa Rapids, Japan.

Fighting Caterpillars With Steam

HORDES of caterpillars proved a serious menace to railroad operation this summer on the McCloud River Railroad, in Northern California. Locomotives could not make traction because of the millions of wriggling crawlers that clogged the rails, forming a slimy mass as the engine passed over them. Sand was of no avail; cresol sprinkled along the rails checked them for only a brief time; and the expedient of placing men on the cowcatcher to sweep off the creatures with a broom was of no value at all. More caterpillars were crushed by the brooms than were brushed clear of the tracks, while those that escaped alive promptly crawled back upon the rails before the train had passed.

Apparently the railroad was under the necessity of digging trenches for many miles along both sides of the right of way, a very heavy outlay, but the only effective method so far discovered of holding the creeping hordes in check. This method had been used with success in the lumber camps of that section, which had also been overwhelmed with the pest.

However this great expense was done away with by an invention of Master Mechanic John Kennedy, who devised a system of forcing live steam from the locomotive boiler upon the rails ahead of the cowcatcher. The heat killed the insects, while the force of the jet threw their bodies off the track without crushing them. In this manner, the problem was solved with slight expense, as Mr. Kennedy's invention was of extreme simplicity. It consists of a couple of small tubes extending from the boiler to the front of the locomotive and terminating a few inches above each rail. The engineer controls the steam outlet with a simple device. After using this invention for a short period, the bodies of countless thousands of caterpillars were banked alongside the track for miles.

Locomotive equipped with steam jets to clear the tracks of caterpillars.

Forcible Feeding in the Lincoln Park Zoo

LAST spring, "Romeo," a huge snake, was trapped in an Indian jungle and brought to the Lincoln Park Zoo in Chicago. Since then thousands of parkgoers who have seen him coiled up in a glass case in the monkey house have thought the snake was dead. But "Romeo" was simply on a hunger strike. Months passed and "Romeo" would not eat. His weight dropped from 300 to 215 pounds. De Vry, the animal keeper, got a mate for the reptile, but "Romeo" remained disconsolate.

One day recently De Vry saw a picture of a "gun" used to feed sick animals, and lost no time in procuring one.

When the gun arrived it was immediately put into service. Twenty keepers led the snake from the glass case and plunged it into a tank of hot water. There his summer coat was removed. The snake was then placed on a fifty-foot board. Forty hands were required to hold him still. The "gun" was fastened at the head of the board. Twenty pounds of chopped pork and beef, mixed with fresh pig's blood, were placed in the cylinder of the feeder, to which a hose was attached. One of the attendants took a pointed stick and forced the snake's mouth open. Whereupon the keeper inserted a board between the jaws. There was a hole in the board to allow the passage of the meat.

The snake was then dragged up to the machine, the hose was placed in his mouth and the crank turned. Fifty pounds of meat was "shot" down the snake's throat before the operation was finished.

Extinguishing a burning oil well by diverting the flaming gases.

Feeding a snake that would not eat.

The Current Supplement

MANY references have been made to the method of passing vessels through the locks at the Panama Canal, but there has been no real description of the ingenious electric towing locomotives that have been specially designed and built to do this important work. The article on this subject in the SCIENTIFIC AMERICAN SUPPLEMENT, No. 2039, for January 30th, 1915, gives such a description, with a number of illustrations that fully show the system adopted, and it will be found a matter of general interest. There is also a valuable paper by Prof. Joly, the well-known scientist, on the Birth-time of the World, discussing various methods of estimating the age of the earth; and the interest in this is increased by the paper on Sea Salt and Geological Time, by H. S. Shelton, who criticizes Prof. Joly's theories. Plancton, the Ultimate Food, contains a fund of information about a form of marine life that, although vast in extent, is little known generally. The Function of Enzymes, those products of living cells that so wonderfully affect the chemical operations of living matter, is the subject of an article dealing with some of the mysteries of life. Roentgenology in War tells of the methods of adapting modern science to the necessities of surgical work in the field. The Hygienic Home impresses some facts of everyday life that should be more thoroughly known and appreciated. There is a third article on liquid crystals by Dr. Lehmann, as well as some notes on the Hypnosis of Fear. In technical subjects there are interesting notes on Iron Manufacture by Electrolysis, and the valuable review of Arithmetical Machines is concluded. The description of a new Hydrogen X-ray Tube, possessing special qualities, is of more than passing value.

Extinguishing a Burning Oil Well

THE accompanying photograph illustrates the plan which was successfully employed in extinguishing a burning gas well in the bed of the Cimarron River, in the Cushing oil field, Oklahoma. The well, before the fire, registered sixty-two million feet of gas. It could not be controlled, and it finally caught fire from a campfire nearly a quarter of a mile away. A wire cable was stretched across the river. On this an immense hood with a tall smoke stack attached, was suspended, and this was finally dropped over the gas. Another cable had been attached to the stack and carried to the river bank. Then a team of horses was hitched to the latter cable. Steam from six boilers was carried to the mouth of the well. All the time the blaze was coming out of the stack. The stack and hood was jerked by the team far away from the well, thus carrying the flame far away from the well, the gas in the stack still burning. Then the steam was turned onto the mouth of the well, diverting the gas still further from the flame, and the fire was thus extinguished.

Profit From Forests

MANY European towns and cities own considerable areas of forest lands, and as these are in almost every case under the constant care and supervision of qualified foresters they are a source of steady profit to the communities. An example of this is cited in recent forest notes by the U. S. Department of Agriculture, which states that Zürich, Switzerland, derives an annual income of $7.20 per acre from her forests, which results in a reduction in the taxes of $32,000 each year.

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Apparel.

DRESS FORM.—M. A. KONIKOFF and H. R. KONIKOFF, care of Kayes Mfg. Co., 496 E. 134th St., New York, N. Y. This invention relates to dress forms, including both the bust and skirt portions, and the main object thereof is to make such forms collapsible, whereby less space is required for storage and for shipping with the consequent saving.

CLOTH CUTTER.—L. H. WILLIAMS, 414 E. Augusta St., St. Joseph, Mo. This cutter has a knife normally disposed within a casing which is mounted on a track bar along which it is adapted to move, the track bar having means for holding the cloth to be cut against a corrugated member on a base to which the track bar is articulated.

WEATHERPROOF GARMENT.—S. LIPMAN, care of Eloisser, Hyman & Co., 77 Battery St., San Francisco, Cal. The garment is preferably in the form of a shirt, more especially designed for use by loggers and other persons and arranged to conceal a weatherproof lining or cape and to allow convenient removal thereof to permit of washing the garment when desired to do so.

Pertaining to Aviation.

AEROPLANE.—O. CALUM, 634 Union St., Brooklyn, N. Y., N. Y. The aeroplane is arranged to provide a large sustaining area in a comparatively small space, to insure easy rising and descending of the aeroplane, to maintain the equilibrium even in heavy sidewise or contrary currents of air, and to allow safe descending in case of accident to the motor or other parts.

Electrical Devices.

POLE.—A. H. MATTHEW, Colville, Wash. Mr. Matthew's invention relates more particularly to telegraph and telephone poles, and it is a design of the inventor to produce an improved metallic, hollow pole adapted to receive a filling of sand or other sound-deadening material. The pole may be shipped in sections.

OPERATING MEANS FOR ELECTRIC-LAMP SWITCHES.—A. J. TIZLEY, 38 E. 15th St., Brooklyn, N. Y., N. Y. The invention provides a rotary lamp switch member with a stud mounted on a leaf spring and movable in a slot in a casing by a cam mounted on a collar so that the switch member may be rotated a distance by the collar and the cam when the collar is rotated in one direction, the leaf spring permitting the stud to move inwardly out of the way when the collar is rotated in the opposite direction.

MEANS FOR FASTENING THE DANGLING END OF A BROKEN OVERHEAD ELECTRIC CONDUCTOR.—A. JÜRGENS, 133 Springweg, Utrecht, Netherlands. The object here is to provide means for drawing up and fastening the dangling end of a broken overhead electric conductor, to prevent short-circuiting of the electric circuit, and to reduce the danger of electric shocks and electrocution to human beings and animals liable to come in contact with the broken end of the circuit conductor.

Of Interest to Farmers.

MOWER.—A. H. MATTHEW, Colville, Wash. The invention relates to a mower or reaper, and the aim is to provide a cutting mechanism and actuating means thereof requiring less expenditure of power for effective operation. The invention provides a novel means whereby the cutters may be raised at an angle, for the cutting of hedges.

APPARATUS FOR DRYING MILK.—J. D. MCINTYRE, New York, N. Y., care of W. De Shetley, Illinois Athletic Club, Chicago, Ill. In this case use is made of a driving gear connected with the agitator shaft to rotate the agitator continually at a high rate of speed during the period of changing the milk to a doughy consistency, and to rotate the said agitator shaft at a decreased speed and a corresponding increase of power during a period of changing the milk from a doughy consistency into granular form.

PLOW.—T. N. SEAY, 620 Richland St., Columbia, S. C. This invention perfains to plows and more particularly to an improvement in hand or garden plows. The invention provides a hand plow having a plow share positioned in front of the wheel, so that the wheel travels in the furrow made by the share, thus allowing an easy manipulation of the plow.

COTTON CHOPPER.—E. R. BURKEY and J. F. VOELPEL, Grand Prairie, Tex. In this device a wheel-supported frame is provided, adapted to be drawn through the field with the wheels astride the row of growing plants, and wherein other mechanism is provided in connection with the frame and supported thereby and moving transversely of the row for cutting out the excess plants, the said mechanism being arranged to cut deep or shallow and being controlled by the operator of the machine.

Of General Interest.

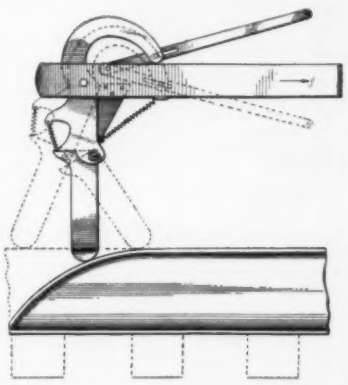
SPOOL.—W. TRENT. Address Frank Strong Stott, Stottville, N. Y. In the present patent the invention has for its purpose the provision of a spool comprising a body and heads detachably connected with the body, and so arranged that when the said heads become mutilated or broken they may be removed from the body and a new head attached.

COMPRESSOR OR ABDOMINAL SUPPORTER.—G. W. KNIGHT, 203 Broadway, New York, N. Y. This invention has for its general objects to improve and simplify the construction of adbominal supports so as to accomplish the purpose for which it is applied and at the

COMPRESSOR OR ABDOMINAL SUPPORT.

same time permit of being easily and quickly attached or detached and while in place be comfortable to the wearer in the natural movements of the body, as in changing from a sitting to a standing posture, or *vice versa*, or in the lateral bending of the body.

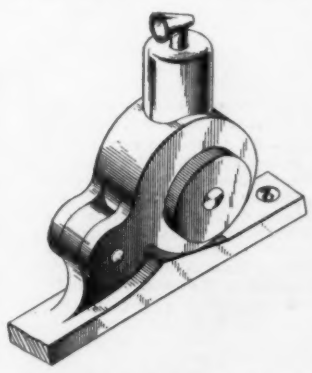
AUTOMATIC WHISTLING AND SIGNALING DEVICE.—J. T. DODSON. Address J. E. Rieger, Attorney, Kirksville, Mo. This invention relates to devices for automatically sounding a whistle or other audible signal on a moving engine, car, or motor vehicle at predetermined points along its route of travel. An



AUTOMATIC WHISTLING AND SIGNALING DEVICE.

object is to provide a device of the type described, which is exceedingly simple in construction, consisting in fact of only two main parts on the engine frame, one of said parts being arranged to engage a stationary trip member on the track.

VARIABLE RANGE PEEP SIGHT FOR FIREARMS.—J. W. HILL, Palisades, N. Y. This invention relates to sights of the peep type for rifles and other firearms, and has to deal more particularly with adjustable or variable range peep sights. The invention improves and simplifies the construction of de-



VARIABLE RANGE PEEP SIGHT FOR FIREARMS.

vices referred to so as to be reliable and efficient in use, comparatively inexpensive to manufacture, and so designed as to enable the sight to be quickly and accurately adjusted for any range within the capacity of the firearm to which it is applied.

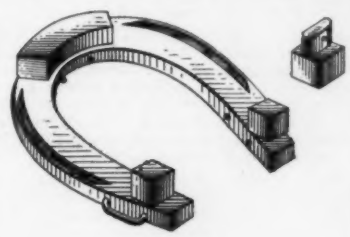
THERMOMETER HOLDER.—C. N. MUELLER and W. V. VAN DOREN. Address the latter, 1646 Garfield Boulevard, Chicago, Ill. This invention relates to a device for holding a thermometer and supporting a receptacle or cup with the thermometer extending thereinto and designed for special use in breweries, distilleries, chemical works and any kind of establishment where liquids are handled under conditions where the temperature must be frequently taken.

OPTICAL PYROMETER.—A. C. BURLEIGH, 611 Blackburn Ave., Sewickley, Pa. This inventor provides an indicator which is heated by the passage of current therethrough, which can be regulated for various temperatures, whereby the color of the heated metal can be effectively demonstrated, the indicator including means for holding a strip of metal which can be heated and reheated at high temperatures without changing its physical properties and without oxidizing.

EYE BATH.—J. E. ROSS, 610 E. Elm St., Springfield, Mo. The invention relates to eye baths consisting of an eye cup combined with means for applying water or other liquid to the eye in the treatment of ocular affections. The device includes means for discharging water under pressure and in the form of sprays against the eye, whereby the hydrotherapeutic action of the water is made use of in the treatment of certain diseases of the eye.

MEASURING DEVICE.—R. C. BRADLEY, 612½ Market St., Shreveport, La. The invention relates to measuring devices and more particularly to a computing cup or scoop. It provides a scoop which may be adjusted for measuring predetermined quantities of commodities and which will indicate the price to be charged for each quantity or amount.

HORSESHOE.—H. PERKINS, Montague, Mass. This invention is an improvement in that class of horse-shoes in which calks are secured to the shoe proper by means of removable fastenings. The shoe is easily manufactured, and combines all the advantages of welded-on calks with the easily removable and



HORSESHOE.

replaced calks and locking devices. In recalking shoes, time and fuel of the blacksmith are saved and also the long wait of patrons at the shop while horses are being shod in the old way. On slippery roads dull calks can be readily removed for future use and sharp ones replaced by anyone in a very short time.

Hardware and Tools.

DOOR LOCK.—M. F. RICHARDSON, 107 E. 128th St., New York, N. Y. This door lock is arranged normally to hold the door securely locked against accidental opening and permitting of unlocking the door from one face thereof by pressure applied to a transverse direction instead of turning a door knob or the like, and to allow unlocking from the other face of the door on pulling the door knob.

WIRE NIPPER AND TWISTER.—J. T. WERTZ, 4312 Vernon Ave., Chicago, Ill. This invention relates to metal working tools and has particular reference to means for gripping and twisting wires such, for instance, as are used for fastening together reinforcement means for concrete structures, although the use of the device is not to be regarded as being limited to the means as herein stated.

CALKING TOOL.—A. E. OLSON, Box 52, Holton, Mich. This tool is for use for filling cracks or seams with cement, pitch, wood filler or similar materials, and is particularly adapted to be moved over a surface after the manner of a plane in which a container chamber is provided, in which a follower is adapted to be depressed to force the filling material downwardly through the bottom of the tool.

DOOR LATCH.—B. L. JOHNSON Goodhue, Minn. The object here is to provide a latch of a novel form, adapted more particularly to be operated from either side of the barn door, in which the handle part, at the interior of the door, will lie within the plane of the door so as to clear the casing in the sliding of the door.

BARB WIRE REEL SUPPORT.—C. A. BEAUJON, Canaan, Conn. This inventor provides a reel support for use in connection with a spool of barb wire, the reel support including a member extending through the axis of the spool and provided at each end with a sleeve whereby such end may be supported by an operator or otherwise, while the shaft is free to rotate with the spool.

TOOL.—F. S. HARRINGTON, 311 W. 117th St., New York, N. Y. Among the principal objects which the present invention has in view are: to provide a separable head, the parts whereof are readily and economically constructed to strengthen the assembled tool, and to provide for wear on the jointed parts of said tool.

PIPE CUTTER.—W. H. JOHNSON, 6201 Loomis St., Chicago, Ill. This improvement provides a device by means of which a portion of the material of the pipe is removed to form the cut, instead of the material being displaced and wedged apart without removing, as in the case with the commonly used cutter.

PENCIL SHARPENER.—E. A. NUGENT, Unionville, N. Y. This pencil sharpener may be carried on the pencil. It is constructed with a knife which makes, with an oblique cut, a long or short point as desired. This knife may be moved out of operative position when it is desired to move the sharpener up from the pencil point. The sharpener forms a rest for the fingers when the pencil is used for writing.

BRACE.—F. GRUWELL and J. T. MCCANN, Address the latter, Tuolumne, Cal. This invention relates more particularly to a brace level, and one of the principal objects is to provide a brace with a brace level whereby the operator of the brace may instantly ascertain whether the brace is being maintained in a vertical or horizontal position relative to whether a vertical or horizontal position is being bored.

Heating and Lighting.

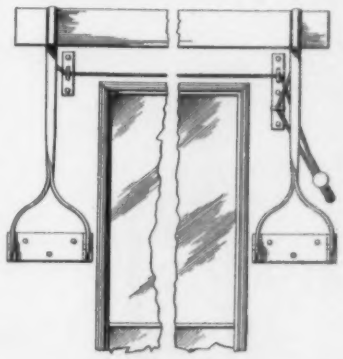
LIQUID FUEL GAS GENERATOR.—R. I. MCKISSACK, P. O. Box No. 1, Nashville, Tenn. This invention provides means for converting liquid fuel into gas combined with adjustable means for mixing the right amount of air with the gas to insure perfect combustion for general and domestic use. It provides a system whereby a more satisfactory initial priming or heating of the generating pipes is obtained for the purpose of starting the process of generating gas from the liquid fuel.

LAMP CHIMNEY.—W. J. WAMBAUGH, Morgantown, W. Va. This improvement provides a chimney adapted to be securely held in position on the chimney support of the lamp by the usual spring clamps to prevent the chimney from toppling over when carrying the lamp about and to insure accurate centering of the chimney relative to the burner.

OPEN FRONT GAS HEATER.—P. MCK. BRADLEY, care of Joplin Stove Co., corner 8th and Main Sts., Joplin, Mo. The invention is an improvement in that class of gas heaters having an open front and provided with curved reflector plates extending backward and upward from the base and forming the back of the cavity or open front of the heater.

Household Utilities.

ADJUSTABLE CURTAIN POLE BRACKET.—A. C. MCARTHUR, Grafton, New South Wales, Australia. This invention has reference to a hanging device for curtains whereby these articles can be kept clear of the wall and may be readily lowered for changing or other pur-



ADJUSTABLE CURTAIN POLE BRACKET.

poses. According hereto poles for carrying curtains are supported in rings or brackets secured to the wall, one on each side of the window. Means are employed for retaining the brackets in any desired position.

WASHING MACHINE.—A. D. BAIRD and EFFIE J. FAVOR. Address Andrew D. Baird, 23 South St., Medford, Mass. The invention provides a portable clothes carrying drum and means for quickly and easily attaching it to a stationary tub and for rotating the drum when in position. It provides a pair of brackets to be secured to the walls of a stationary tub, to support a rotary clothes carrying drum, the brackets also provided with means for rotating the drum in supported position.

FAUCET.—F. BECKER, National Café, McKeesport, Pa. Among the principal objects which the present invention has in view are: To provide a driving faucet having means for preventing the flow of the liquid while installing the faucet in service relation; and to simplify and economize the faucet construction.

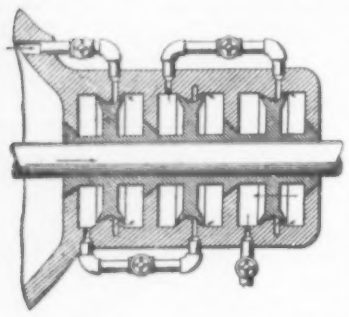
CURTAIN PIN.—E. W. MUNDT, 246th St. and Albany Post Road, Van Cortlandt Park, New York, N. Y. The invention provides a curtain pin of a simple and cheap construction of a nature serving to prevent the fabric from becoming caught or snarled in any manner, and secondly, to provide improved locking means not only for the hook portion, but also for the pin.

CASSEROLE FRAME.—J. J. O'MARA, 261 Lorimer St., Brooklyn, N. Y., N. Y. This invention relates to casserole frames or similar utensils and more particularly to an article employing a method of joining the ends of a band of solid or reticulated material and simultaneously forming a foot and handle and rendering the band continuous in appearance.

Machines and Mechanical Devices.

STAPLING MACHINE.—A. H. FERRELL, Appleton, Minn. The invention has for its more particular purpose the provision of means for perforating the stock independently of the work done by the staple as the latter is driven into the stock; the perforation being made, however, and the staple being driven into or through the stock at practically a single operation.

COMBINATION THRUST BEARING AND FLUID SEAL.—W. J. WOHLENBERG, 542 Boulevard, Norman, Okla. An object of the inventor is to provide a bearing and seal combined in which the thrust is balanced by fluid pressure oppositely directed, with means for automatically adjusting the said oppositely directed

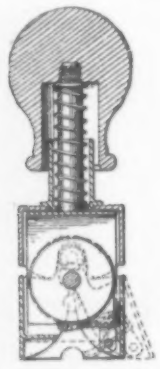


COMBINATION THRUST BEARING AND FLUID SEAL.

fluid pressures. The invention provides a combined thrust bearing and fluid seal wherein the relative position between the rotor and stator is fixed by the fluid pressures oppositely directed. The invention provides a thrust member having a multicellular arrangement in which the fluid pressure is caused to gradually decrease in each successive cell.

SAND PUMP FOR OIL WELLS.—J. H. MCGEE, Box 342, Humble, Tex. Mr. McGee's invention is an improvement in sand pumps for oil wells and the like, and has for his object to provide a pump especially adapted for removing sand and mud from deep wells, as, for instance, driven wells and the like.

HAND STAMPING MACHINE.—A. MARKS, care of The Traut & Hine Mfg. Co., New Britain, Conn. The invention has particular reference to a machine made principally of metal and having consequently a set of metallic type characters as distinguished from stamping de-



HAND STAMPING MACHINE.

vices having rubber characters. An object of the inventor is to provide a device of a very simple and compact nature, whereby the trade may be supplied at a low cost with a machine which will meet all ordinary requirements.

BORING DEVICE.—J. E. BROOKS, H. H. SLEPPY, and J. J. YARNELL, East Wilmington, Cal. An object of this invention is to provide a power device by means of which post holes or holes for electric light poles may be bored quickly and economically. A further object is to provide means for boring holes of different depth.

NEWSPAPER WRAPPING AND LABELING MACHINE.—E. T. PETERSON, Cimarron, Kan. This invention relates to wrapping machines or the like and has particular reference to machines which are adapted to wrap, seal, and label automatically newspapers or similar articles. Another object is to improve the mechanism for controlling the application of labels to the wrapping paper previous to the application thereof to the newspapers.

DEVICE FOR CLOSING SLIDING DOORS.—J. H. RYE and J. E. FLEXNER. Address the former, Boissevain, Va. The invention has reference to improvements generally in the means for actuating the door and for the spring mechanism and parts immediately associated therewith, for the purpose of enabling the operator to adjust the sensitiveness of these parts.

ATTACHMENT FOR ROTARY WELL BITS.—T. A. BERCHER, Cochrane, Alberta, Canada. This invention relates particularly to a safety device designed to recover lost rotary bits, and has for an object to provide a structure which will not only hold the lost or broken off portion so that the same may be withdrawn, but will cause an indication at the surface showing that the bit is broken or lost.

SWITCH STAND.—S. F. PHILIPS. Address Goldstein and Miller, El Paso, Tex. This stand has mechanism for throwing the switch, and in addition signal mechanism, so arranged and connected to the operating mechanism of the switch that when the switch is in closed and locked position the signal will be at safety, and wherein the signal operating mechanism is so connected with the switch operating mechanism that the latter cannot be operated to open the switch until the signal is set at danger, and wherein the signal cannot be moved into the safety position until the switch is returned to closed and locked position.

MECHANICAL LUBRICATOR.—M. JAEGER, 125 North Terrace, Mount Vernon, N. Y. The invention has for its purpose to provide an improved structure which may be continuously operated and caused to feed any desired quantity of oil either continuously or intermittently to an article or piece of machinery being lubricated.

ATTACHMENT FOR TESTING MACHINES.—G. S. EVANS, care of Lenoir Car Works, Lenoir City, Tenn. An object here is to provide a device by means of which a testing machine such as that used for transverse tensile and compression testing is made use of in testing hardness. A further object is to provide a device by means of which hardness may be tested according to the so-called Brinell ball impression test.

HOLDER AND DELIVERY DEVICE.—J. E. KENKEL, care of W. J. Beecher, Great Falls, Mont. This invention provides for accommodating a very large number of toothpicks or matches in a comparatively small space; provides for the convenient manipulation of the device by successive users; and provides a discharge or outlet adapted to be conveniently positioned for the delivery of the articles.

MACHINE FOR REWINDING FILMS.—G. B. VAN AKIN and J. E. BONST. Address Tripp & Burleigh, Hudson, Mich. In this case the improvement relates to motion picture mechanism, the more particular purpose being to provide a convenient means for rewinding the photographic films, so as to leave these films in proper shape and position to be unwound.

HOT PLATE PRESS FOR WOOD VENEERS.—O. P. BUSHNELL, 78 Bill St., Belleville, N. J. The invention provides a press adapted to uniformly limit the spread of the plates for the escapement of steam; provides means for regulating the number of times when the plates are spread for the escapement of steam; provides means for automatically opening the plates for delivery of the veneer from therebetween; and provides heating plates having protected steam channels formed therein.

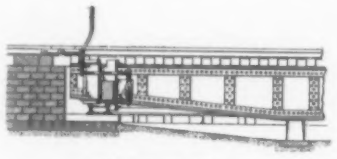
REPEATING RIFLE.—J. W. MONTAGUE, 301 Kennedy Block, Portage Ave., Winnipeg, Manitoba, Canada. In this rifle the breech bolt is rotated by the reciprocation of the sleeve and thereby cocks the rifle hammer by a cam action, the cams interlocking after the cocking action has been completed, by a forward motion of the hammer holding the several parts rigid after the bolt is turned, until it is necessary for the bolt to turn back into its proper place.

Prime Movers and Their Accessories.

WATER GLASS.—L. B. HOWELL, Wilmington, N. C. This invention has reference to emergency valves as applied to boilers, and an object of the improvement is to provide means for automatically injecting water into the boilers when the water in the boiler has reached a predetermined height.

Railways and Their Accessories.

RAILWAY TURNTABLE.—A. MEIKLE, North Transcona, Manitoba, Canada. This invention provides means to chock the turntable at the periphery to prevent a depression thereof by the engine entering the same. A further cause of injury to engines and the turntable is the fact that the track rails of the turntable do not make a close joint with the fixed tracks.



RAILWAY TURNTABLE.

The invention provides means for producing a continuous track from the fixed track to that of the turntable, for which purpose use is made of a filler track section rockably mounted on the turntable, and in order that the filler track section and chocks may move in unison, the said section is mounted on a rock shaft and operative connections established between the said rock shaft and the chocks.

FLAGSTAFF.—F. H. KINNEY, P. O. Box 97, Hemlock, N. Y. The invention has special reference to a flagstaff adapted for use on railroads, and provision is made on the base section and in connection with the top member of the cap section for tying the upper and lower ends of a plurality of signal flags, as, for instance, red, yellow, and green flags. Between the top and bottom tying-means for the flags, sliding rings are provided for connection with the respective flags.

CAR DOOR SEALING DEVICE.—H. V. COOKINGHAM and GEORGE O. PRICE. Address the latter, 585 Washington Ave., Albany, N. Y. In this case use is made of a lock-controlling lever fulcrumed on the car door and having an opening for engagement with one of a series of studs held on a keeper fixed to the car door, and a movable locking member on the said lever for locking the latter in position on the keeper when the lock is in open or closed position.

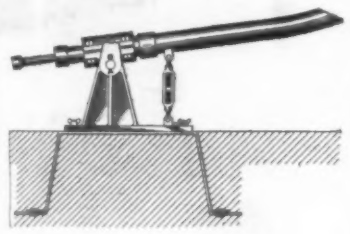
MAIN ROD CONNECTION.—R. M. MUSGROVE and F. R. HOWARD, care of Musgrove, Howard & Co., 144 W. First South St., Salt Lake City, Utah. The invention in this instance relates to connecting rods, particularly to those connecting the driving wheels of locomotives, and the main object thereof is to distribute the strain of the engine over all the pins of such wheels equally.

Pertaining to Recreation.

JUGGLER'S PARAPHERNALIA.—F. P. LITTLEJOHN, care of Vanity Publishing Co., Times Square, New York, N. Y. The object of the invention is to provide a light, convenient and inexpensive device having a brilliant light-reflecting surface not damageable by falling or hammering. This is obtained by providing a device with depressible surfaces on which a light-reflecting medium is provided.

PUZZLE.—B. GUNNER, Hillburn, N. Y. This invention relates to the general class of games and toys and has to do more particularly with a pocket puzzle which calls for a display of a high degree of ingenuity and resourcefulness in effecting its solution, while at the same time the puzzle affords considerable amusement and entertainment.

LAWN GAME.—J. NORTON, 700 E. 165th St., New York, N. Y. This game, to be known as "Lawnette," consists of a projecting apparatus having means for anchoring the same in the ground, such apparatus being pivotally



LAWN GAME APPARATUS.

mounted so as to be adjusted at different inclinations whereby balls designed for use with the apparatus may be projected at different elevations and distances therefrom.

Pertaining to Vehicles.

WHEEL RIM.—W. G. BLOECHER, 2909 Edmondson Ave., Baltimore, Md. The rim is especially adapted for use with wire wheels and designed for co-operation with interchangeable tire-carrying rims, the interchangeable rims seating outside of the wheel rim, the wheel rim having at one side edge a fixed stop and having at its edge a series of releasable stops to permit the quick removal and replacement of the interchangeable rims.

BALLOON.—L. D. BROOKS, 2914 Mission St., San Francisco, Cal. The object here is to provide a device wherein a vehicle is provided having connected therewith a balloon or other envelope for containing gas, having a lifting capacity slightly less than the aggregate weight of the vehicle when loaded, and wherein means is provided for the occupant for lifting the vehicle, and wherein other mechanism is provided for permitting the vehicle to move over the ground.

WHEEL.—C. H. REYNOLDS, Maxwell, Cal. The purpose here is to provide a wheel adapted for use in automobiles and the like, wherein the hub is resiliently connected with an inner wheel, which in turn is supported by the rim, the hub being so arranged that it may yield in every direction with respect to the rim.

TIRE.—S. A. SHERMAN and J. STIVESON, 197 Dewey Ave., Youngstown, Ohio. The invention has reference to a tire having a removable wearing tread. The object thereof is to provide a durable tire having a removable tread which can be easily and quickly replaced and which is maintained in proper position on the tire by the resiliency thereof and the pressure applied to the tread.

FOLDING BACK FOR SADDLES.—G. W. SPRINGSTEEN, 58 Moffatt St., Brooklyn, N. Y., N. Y. This invention provides a folding back for the saddles of motor cycles, bicycles, and other vehicles and devices, and arranged to normally hold the back in an inactive folded position to permit the rider to conveniently mount and dismount, and to automatically move the back into active position relatively to the saddle when the latter is occupied.

DIRECTION INDICATOR FOR AUTOMOBILES.—VICTOR GILSEY and OLIVE S. GILSEY. Address the former, 620 W. 122nd St., New York, N. Y. This improvement refers more particularly to a direction indicator for automobiles designed to operate in the rear of a car to warn the chauffeur of an approaching car in the direction of travel of the preceding car, thus providing an efficient means for obviating collisions and accidents which would otherwise be caused.

COMBINED SPEED CONTROLLER AND BRAKE.—T. DOUGLAS, 80 Maiden Lane, New York, N. Y. The invention is especially adapted for use in motor-driven vehicles, and refers more particularly to the combination with a governor for regulating the flow of combustion fluid to an internal combustion motor, of means for admitting non-combustive fluid to the motor, to be compressed and exhausted through the motor, whereby the same serves to operate as a brake.

RIM SPREADER.—G. E. POWERS, Xenia, Ohio. The invention relates to wheelwrights' tools, and more particularly to a tool for spreading or drawing the rim of a wheel during the operation of attaching the rim to the

RIM SPREADER.

spokes. One of the principal objects is to provide a tool which may be clamped to the ends of a half rim and operated to spread the rim or draw it, as desired, in order to facilitate the adjustment of the rim to the wheel spokes.

RESILIENT WHEEL.—W. H. RANDALL, 1149 Tauromee Ave., Kansas City, Kan. When this wheel is in use, shocks due to unevenness in the road as the wheel passes thereover will be taken up by the resilient spokes, and when any one section of the rim is bearing against the ground tending to support the weight rest-

RESILIENT WHEEL.

ing on the axle, this weight is carried by the three spokes in turn supported on a single pin. This construction provides that the load on the axle will be successively distributed at diametrically opposite points as the wheel rolls over the ground, and movement or displacement of the rim being taken up by all of the spokes.

Designs.

DESIGN FOR A COVER DISH.—E. J. JOHNSON, care of Johnson Bros., 46 W. Broadway, New York, N. Y. In this design for a cover dish the plan view shows a cover oval in form with a handle at each end. This and the side view represent a dish of exquisite lines and effective ornament.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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Legal Notes

Design Patents for Parts of Previous Design.—In *ex parte* Sanford, Assistant Commissioner Newton holds that where a design patent for a pitcher including its top has been granted and later without undue delay the patentee files an application for the top alone, which could not be included in a single patent with the pitcher including the top, the patent does not bar the allowance of the application.

Reciting Foreign Applications in Oath.—The importance of reciting the filing of foreign applications, which may have been filed in the oath of the United States application, is emphasized by the decision of Commissioner Ewing in the interference case of Steel and Steel v. Myers. In such case the Commissioner said, "If an applicant who is involved in interference has stated in the oath to his original application that he filed the application in a foreign country, that should be taken, in my opinion, as establishing *prima facie* that the foreign application was filed by him or with his knowledge and consent. If, however, the original oath does not state that the foreign application had been filed, but the allegation is made in a subsequent oath or in the preliminary statement, the applicant should, in view of the conflicting affidavits, be given the benefit of the filing of the foreign application only upon a stipulation of the parties or where it is established by duly taken testimony that he was in fact the party who filed the foreign application or that it was filed with his knowledge and consent."

Decisions.—The judgment of the Circuit Court of Appeals for the Eighth Circuit in Rossmann v. Garnier decides some interesting trade-mark questions. It is held that the Federal Courts have jurisdiction of all matters arising under the trade-mark statute, even though both parties be citizens of the same State, and that Congress has power under the Constitution of the United States to enact the trade-mark laws, especially as a "trade-mark" is a distinctive mark of authenticity through which the products of particular manufacturers or the vendible commodities of particular merchants may be distinguished from those of others. It is also held that the provisions of the act of February 20th, 1905, are not limited to technical trade-marks; that a word used exclusively for ten years may be registered under that provision, even though it is a descriptive word, and that where the registrant neither gave notice of the registration by affixing a notice to that effect to the articles sold under such trade-mark nor notified defendant of the infringement, damages were not recoverable for the infringement.

Some Interesting Ideas Concerning Aggregation.—Mr. Justice Baker of the United States Circuit Court of Appeals, Seventh Circuit, in Krell Auto Grand Piano Company of America v. Story & Clark Company, et al., suggests that "aggregation" in the law of patents means that the claims in and of themselves, independently of the prior art, show that the elements are incapable of coacting to produce a unitary result. Further that a patent for a mechanism consisting of two or more elements is not necessarily invalid as an aggregation because there is no direct coaction between the elements where such coaction comes to produce a unitary result through the mediation of the operator or the operating force. In discussing the case the Court said, "It is only through the mediation of the operator that the parts coact to produce the new, unitary result. Operator stands as motive power. So the oscillating holder and the fixed cutter can be a lawful combination only because the existence and the proper application of power are necessarily implied."

Application of Patents as References.—The case of *ex parte* McCollum decided by Assistant Commissioner Newton is interesting as explaining when a combination of references is applicable. Thus he says, that in determining the patentability of a claim over features found only in a plurality of references, it is necessary to consider the structural differences specified in the claims as well as their functional differences or result and that if the structures

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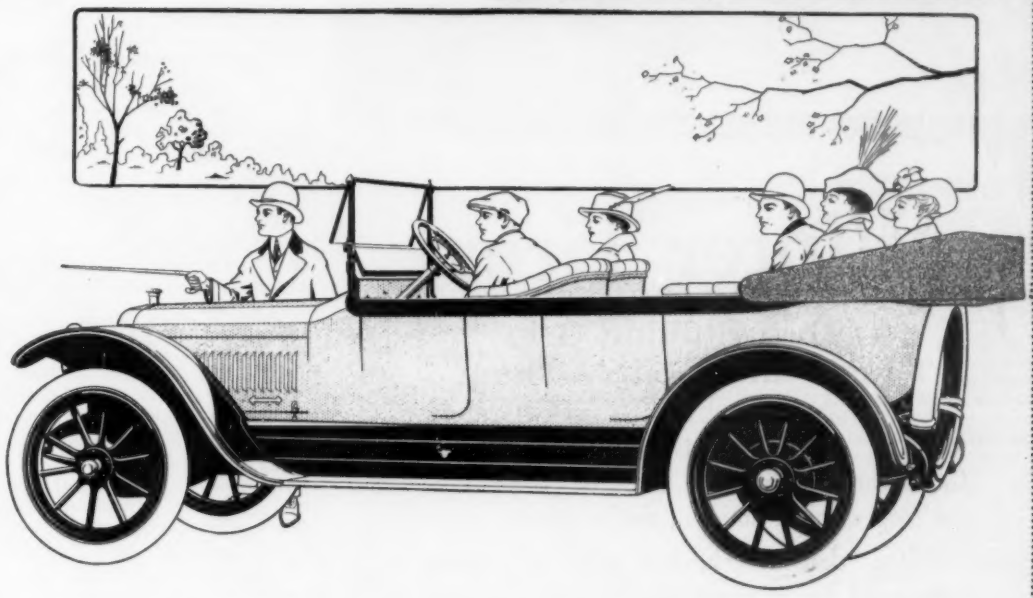

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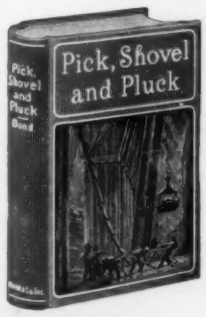

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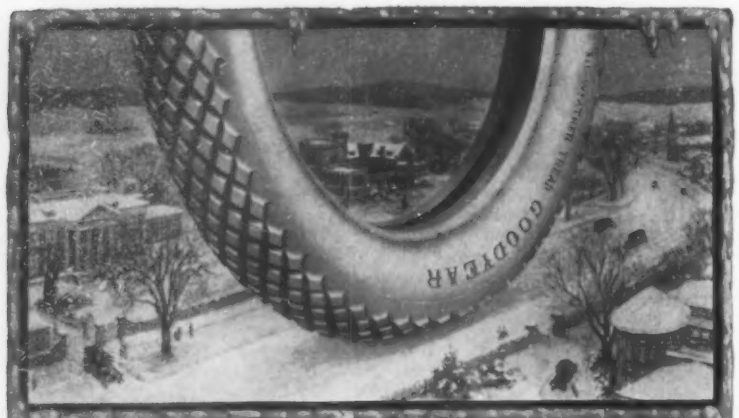

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of the several references cannot be combined without the exercise of invention, even though the result is old, the claim should be allowed. Also if the structures of the references may be combined or substituted one for the other and the combined function or result is new, the claim should be allowed. It is only when both the structural features found in the references may be combined without invention to meet the structure called for by the claim and the function or result involves no invention that the claim should be rejected.

The Heavens in February

(Concluded from page 102.)

the 10th, when Mercury will be about 8 degrees above Jupiter; then they draw together again, and are in conjunction once more on the 18th, but by this time they are too near the Sun to be observable.

Venus is a morning star in Sagittarius, and is very conspicuous, in spite of her great southern declination. She is at her greatest elongation west of the Sun on the 6th and rises about 4:15 A. M.

Mars is theoretically a morning star, being just past opposition, but practically he is too near the Sun to be seen.

Jupiter is an evening star until his conjunction with the Sun on the 24th. He will be visible during the first half of the month, as already described.

Saturn is on the borders of Taurus and Gemini and very well placed for observation, crossing the meridian at 8 P. M. in the middle of the month.

Uranus is in conjunction with the Sun on the 1st and is invisible.

Neptune is in Cancer, about one quarter of the way from the fine double star Zeta Cancri toward Beta Geminorum, but is invisible except with telescopic aid.

The Moon is in her last quarter a few minutes after midnight on the morning of the 7th, is new a little before midnight on the evening of the 13th, and is in her first quarter at 10 P. M. on the 21st. She is nearest us on the 7th, and remotest on the 21st. There is no full moon in February this year, though—or, rather, because—there were two in January—on the 1st and 30th. There will be two in March, on the same days of the month.

There will be an annular eclipse of the Sun on February 13th, but it is of little interest to Americans, for the track of the shadow lies mainly in the Indian and Pacific oceans, crossing land only in Western Australia and New Guinea. A large partial eclipse is visible in Australia, and in most parts of the East Indies, but New Zealand lies entirely outside the track even of the penumbra.

Princeton University Observatory.

Government Co-operation With Our Industries

(Concluded from page 99.)

of the German coal-tar chemical industry, for example, cannot now be started in this country. No capitalist would be fool enough to engage in it, without knowing how far he could meet German competition with its own weapons in home and foreign markets. Where, then, is the incentive to spend fortunes in industrial research, in establishing highly ramified channels of distribution, in building up industries which could not long withstand the attacks of a formidable and enterprising foreign competitor who is permitted to use the very implements which our Government has snatched from our hands?

We are not pleading here for a return to the old days when trusts held us in the hollow of their hands, but we are pleading for a judicious and controlled use of the economic advantages that accrue from production and distribution on a large scale. The trust and the cartel are not unmixed blessings for Germany; but so long as they play a predominant part in forcing us out of foreign markets, so long as they are supported by a paternal government as part of a well-planned scheme for German commercial expansion, so long will it be impossible for us to build up great industries dependent on foreign markets as an outlet for surplus products.

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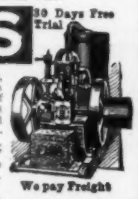

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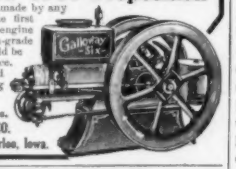

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NEW BOOKS, ETC.

THROUGH THE BRAZILIAN WILDERNESS. By Theodore Roosevelt. New York: Charles Scribner's Sons, 1914. 8vo.; 382 pp.; with illustrations from photographs by Kermit Roosevelt and other members of the expedition. Price, $3.50 net.

Theodore Roosevelt is so many-sided that it would be idle to prescribe boundaries to a genius toward which Nature has been so prodigal; but whatever he may or may not be, it is safe to say that he is a born naturalist. His sympathies extend to the most minute life. He is always alert, interested, sensitive to the most subtle impressions, yet almost brutal in his strength to overcome obstacles. Every American must take pride in the zoological and geographical results of the Roosevelt-Rondon expedition. Over 2,500 birds and 500 mammals, besides reptiles, batrachians and fishes, many of them new to science, stand as mute evidence of its zoological success. But its geographic work is supreme. On the map has been placed the River of Doubt—a twice-justified appellation in view of the storm of argument it brewed—now officially known as the Rio Theodoro. This main affluent of the Madeira is 1,500 kilometers in length. As to the literary value of the volume, the author shows himself capable of a simple, plastic expression that passes easily from poetic description to accurate notation and summation; from adventurous narrative to a shrewd appraisal of human traits. His adaptability to circumstance is shown in his keen enjoyment of literary classics while swathed in head-net and gauntlets and weary to the point of exhaustion. The verdict on Theodore Roosevelt's latest work must be that it is a remarkable book by a remarkable American.

THE END OF THE TRAIL. The Far West from New Mexico to British Columbia. By E. Alexander Powell, F.R.G.S. New York: Charles Scribner's Sons, 1914. 8vo.; 462 pp.; with 48 full-page illustrations and a map. Price, $3 net.

The author tells, and tells delightfully, of that West which cannot be seen from a car window or from the terrace of a fashionable hotel. From Mexico to the edge of Alaska he traveled by motor car. Desert dawns, the miracles of irrigation, freakish rocks and rolling rivers—for each natural wonder the author finds the one apt phrase that paints it to admiration. Then there are the man-made curiosities, such as the Acoma dwelling, to the first floor of which you must descend "precisely as you gain access to the hold of a ship." And not least in interest is the man himself in all his varied aspects and activities, but always, schooled by the exactions of his open life, virile and adventurous. Here the old frontier life still lingers, and though the stage that rocks over the mountain road may have motor-power and rubber tires, the old thrills are still there, augmented by several new ones. Ancient, weather-mellowed missions bring into the picture little oases of perfect peace. Farther along are the oil-fields with their gaunt derricks and their oily, pungent streams. Mr. Powell's intense narrative is a book for a man to read.

THE BASKETRY BOOK. Twelve Lessons in Reed Weaving. By Mary Miles Blanchard. New York: Charles Scribner's Sons, 1914. 8vo.; 111 pp.; illustrated. Price, $2 net.

A good manual of a very popular handicraft comes to us under the title "The Basketry Book," in which Mary Miles Blanchard presents a series of graded studies in the art. Basketry, whose origin is lost in the dim distance of antiquity, is the mother of textile weaving. Here its materials, tools and processes, with the eight fundamental weaves, are clearly set forth, and designs both in black and white and in color enhance the beauty and usefulness of the manual. There are work baskets; baskets for jardinieres, flowers and candy; scrap and gathering baskets. The tables of weaves, coils, measurements and borders will prove enlightening to the novice, and the feature of questions and answers is a distinct aid in fixing principles and terms in the memory.

TEN THOUSAND MILES WITH A DOG SLED. A Narrative of Winter Travel in Interior Alaska. By Hudson Stuck, D.D., F.R.G.S., Archdeacon of the Yukon. New York: Charles Scribner's Sons, 1914. 8vo.; 420 pp.; illustrated. Price, $3.50 net.

These arduous journeys over the frost-bound trails of Alaska were undertaken in the routine of religious duties. But the author is not only a Doctor of Divinity. He is also a Fellow of the Royal Geographical Society, and his trained observational powers find swinging scope in the fascinating and informing record of these winter expeditions. The reading public are accustomed to being regaled at one time upon the picture of Alaska as an Arctic waste, at another as an El Dorado. Dr. Stuck errs neither on the one side nor on the other. We see the country in its wilder aspects; we glimpse its possibilities in minerals and in produce. Above all, its enduring and adventurous population appeals strongly to our bias toward the heroic, and instills a vital element into the relation. Such a land must have its problems, and these are sketched with a sure pen. Among the abundant full-page plates which spread the land and its mixed peoples before our gaze are several in color, one, depicting "Overflow Ice," being particularly good. The author has covered his huge canvas in a masterly manner, until the physical characteristics of nature and of man stand out before us in sweeping line, yet rich in varied detail. We hear the eternal phonograph drawl its nasal jokes to the edification of the native Alaskans; we travel glare ice in a temperature of "50 below;" we have an opportunity of contrasting the Englishman and the Eskimo; and we meet the irrepressible pros-

—his sore throat may be *yours* tomorrow!

AND daily you are forced to expose yourself to just such dangers of infection. For as often as you enter a stuffy car or any other *crowded* place, just so often you are forced to inhale untold numbers of germs, some harmless, others harmful, which settle in the throat linings.

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Scientific American Supplement No. 1501—Treats of the Mechanics of the Gyroscope. A clear explanation without mathematics.

Scientific American Supplement No. 1534—"Little-known Properties of the Gyroscope" describes a peculiar action not generally observed, and discusses the effect of this property upon the motions of the planets.

Scientific American Supplement No. 1864—The Gyro Compass, its principle and construction.

Scientific American Supplement No. 1621—The Gyrostat for Ships describes the construction and application of the principle to prevent rolling of vessels.

Scientific American Supplement No. 1943—Gyroscopic Stabilizer for Ships, by Elmer A. Sperry.

Scientific American Supplement No. 1604—Gyroscopic Apparatus for Preventing Ships from Rolling, takes up the Schlick invention described first in No. 1621, and discusses its action and results fully.

Scientific American Supplement No. 1645—The Theory of the Gyroscope is an excellent article, treating the subject mathematically, rather than popularly.

Scientific American Supplement No. 1649—The Gyroscope, is an article giving a full discussion of the instrument without mathematics, and in language within the comprehension of all interested.

Scientific American Supplement No. 1716—A Recent Development in Gyroscopic Design, illustrates a new form of gyroscope and mounting adapted to engineering uses.

Scientific American Supplement No. 1643—The Gyroscope for Balancing Aeroplanes, takes up this interesting field, which the gyroscope alone seems capable of occupying.

Scientific American Supplement No. 1741—Gyroscopic Balancing of Aeroplanes, tells of various suggested methods of maintaining equilibrium.

Scientific American Supplement No. 1773—The Wonderful Gyroscope, gives diagrams of the Gyroscope and its action, and applications to maintaining stability of ships and monorail trains.

Scientific American Supplement No. 1872—The Mechanical Principles of Brennan's Monorail Car. A lucid exposition.

Scientific American Supplement No. 1814—The Regnard Aeroplane, describes the latest design of aeroplane stabilizer, from which great things are expected.

Scientific American Supplement No. 1861—The gyrostatic force of rotary engines, its nature and significance for aviation.

EACH number of the Supplement costs 10 cents. A set of papers containing all the articles here mentioned will be mailed for $1.50.

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Seen from the rear, William was unrecognizable—but interesting. He appeared to be a walking clothes-boiler, armed with a shield and connected, by means of a wash-tub, with a negro of informal ideas concerning dress. In fact, the group was whimsical, and three young people, who turned in behind it out of a cross-street, indulged immediately in fits of inadequately suppressed laughter, though neither Miss May Parcher nor Mr. Johnnie Watson even remotely suspected that the legs beneath the clothes-boiler belonged to an acquaintance. And as for the third of this little party, Miss Parcher's visitor, those peregrinating legs suggested nothing familiar to her.

"Oh, see the fun-ee laundrymans!" she cried, addressing a cottony doglet's head that bobbed gently up and down over her supporting arm. "Sweetest Flopit must see, too! Flopit, look at the fun-ee laundrymans!"

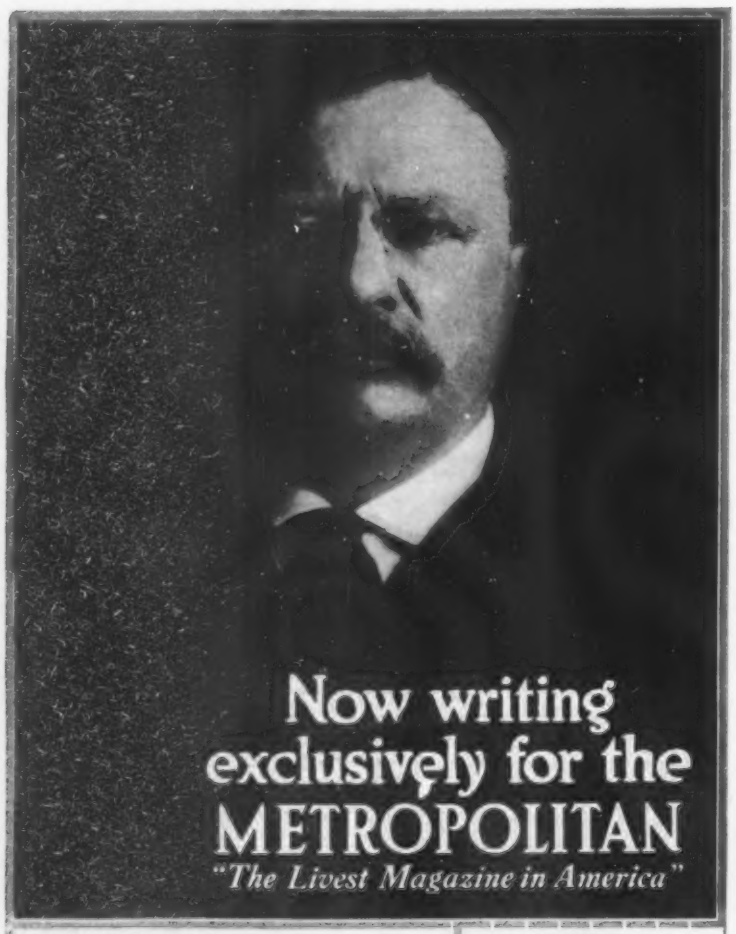
"Sh!" murmured Miss Parcher, choking. "He might hear you!"

He might, indeed, since they were not five yards behind him and the dulcet voice was clear and free! Within the shadowy interior of the clothes-boiler were features stricken with sudden, utter horror. "*Flopit.*"

The attention of Genesis was attracted by a convulsive tugging of the tub which he supported in common with William; it seemed passionately to urge greater speed. A hissing issued from the boiler, and Genesis caught the words, huskily whispered:

"Walk faster! You *got* to walk faster!"

For further horrible details see "Seventeen," by Booth Tarkington, in the February **METROPOLITAN**—the first of a series of new boy stories by the creator of Penrod. All good newsstands—15 cents.



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Notes and Queries.

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

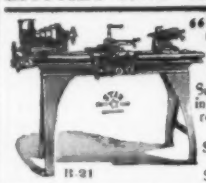
(13033) R. S. J. asks: 1. What is the greatest altitude yet reached by sounding balloons? A. The highest point reached by a sounding balloon of which we have a record is given in the SCIENTIFIC AMERICAN, vol. 108, No. 6, page 134, as 23.4 miles. We will send the paper for ten cents. 2. What are the possibilities of the future in ascertaining temperature, wind velocity, etc., at a height of say 50 miles above the surface of the earth? A. Our own opinion is that the air is too rare to support a balloon at the height of 50 miles, and that that altitude will not be reached. Still it is dangerous to say "impossible" in regard to anything. 3. What is the greatest speed in revolutions per minute which has been obtained in practice for a gyroscope? A. We cannot say what is the highest velocity which has been attained by a gyroscope disk. 4. If it were desired to obtain a speed of say 1,000,000 revolutions per minute for a gyroscope or flywheel (supposing heating due to friction overcome) what means could be employed to obtain this speed? A. We do not think the speed of a million turns per minute can be obtained by any means at the command of man. No driving gear could endure such a speed. 5. Is it supposed that the oscillations of a wireless discharge penetrate entirely our atmospheric envelope and continue through space until dissipated? A. The waves of the ether which are used in wireless telegraphy are guided by the surface of the earth, where that surface is a good conductor, and are held to it. They therefore follow the curvature of the earth's surface. You will find this matter discussed in Pierce's "Principles of Wireless Telegraphy," Chapter XV. We will send this book for $3. 6. In theory the ether offers no mechanical friction. What about electro-magnetic waves passing through space? Are they subject to any retardation as compared to their condition in our atmosphere? A. Electro-magnetic waves are sent through space from the sun to the earth. The earth responds to the outbursts upon the sun. And there are those who advocate the theory that electrons are shot from the sun to the earth, giving to the earth its electric charge.

(13034) J. S. H. asks: Do you know of any tool or process whereby I can make a hole in porcelain fuse blocks? Not a matter of cost, but how can I make the holes? A. You can bore a hole in porcelain in the same way that glass is drilled. Use camphor dissolved in a mixture of turpentine and ether. Take 3 parts of ether, 12 parts of turpentine, and 8 parts of camphor. The sharp corner of a freshly broken three-cornered file will serve best as a drill, working it about with the hand. Labor and time will be the principal items of cost, but they "come high." You will find several methods for doing such work in our "Cyclopedia of Formulas," page 491. We will send this valuable work for $5 by mail, charges paid.

(13035) W. L. asks: Please tell me what the heaviest known metal is. A. There are five metals which weigh more than 1,000 pounds per cubic foot. They are: Iridium, 1359-1399; osmium, 1335-1398; platinum, 1322-1354; gold, cast, 1202-1207; uranium, 1143-1163. 2. What is the pressure of water in the ocean per foot in depth, and the weight of water per square inch as the depth increases? I have failed to find this information in your reference books. Have you a small book that gives information along this line on water pressure, and atmosphere pressure, for sale? A. The pressure of water increases below the surface at the rate of 14.7 pounds per square inch for each 34 feet. From this you can calculate the pressure at any depth. The weight of water increases below the surface very little, because water is almost incompressible. Its rate of compressibility is 0.000044, so that at the bottom of the ocean it is only 1/20 heavier per cubic foot than at the surface. This is so little that for moderate depths it may be neglected. We have no book especially upon this subject. These figures are usually given in text books of physics.

(13036) H. A. H. asks: Some time ago, in your query column, you mentioned the name of a text book you could recommend. Would you kindly advise me as to the name of it? Also of any that have appeared in the interim. A. The query to which you refer related to a text book in physics, especially prepared for the use of girls and having especial reference to the household. The text book which we mentioned was Millikan and Gale's "First Course in Physics," which we will send for $1.45 postpaid. Since that query was written two books have been published in this line. Lynde's "Physics of the Household," price $1.45 postpaid, and Butler's "Household Physics," price $1.50 postpaid. We shall be pleased to fill your order for these books.

LATHES AND SMALL TOOLS



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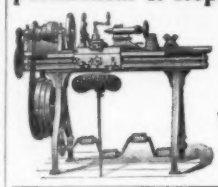

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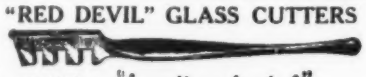

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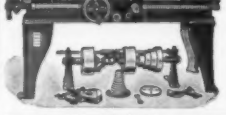

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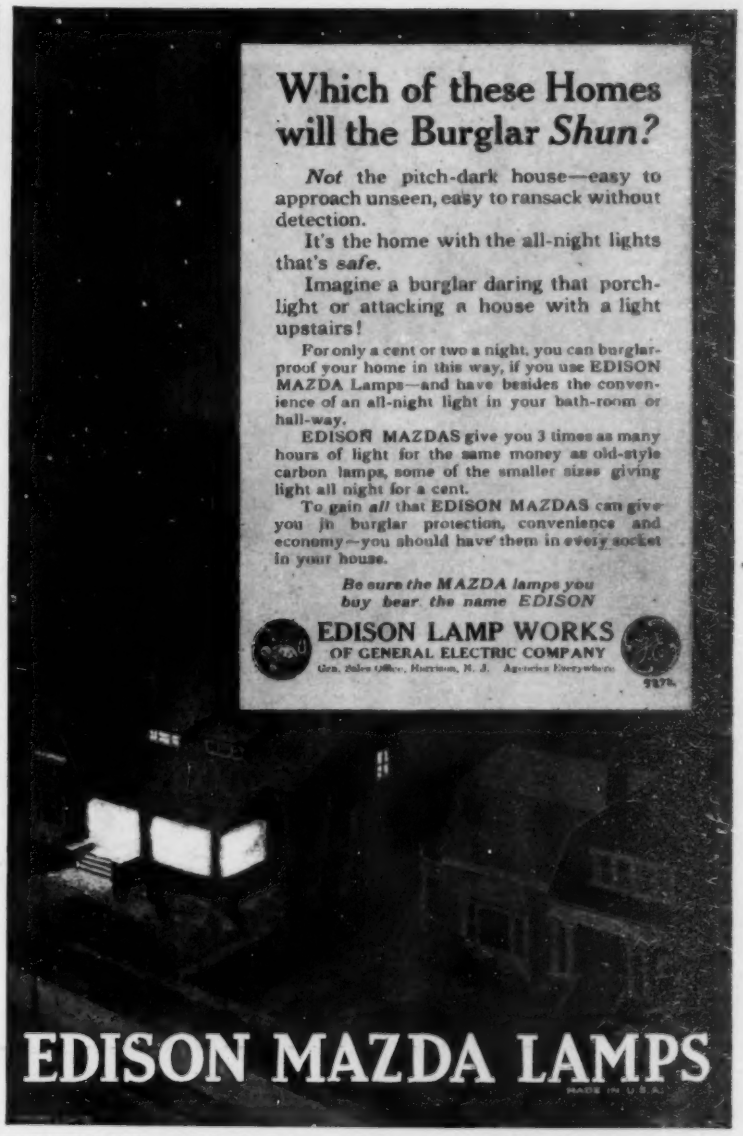
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Balance Sheet, January 1, 1915

ADMITTED ASSETS

Real Estate	$9,826,142.06
Loans on Mortgages	156,674,059.30
Collateral Loans	150,000.00
Loans on Policies	153,375,218.04
Bonds and Stock (Market Value Dec. 31, 1914)	438,322,671.10
Cash	13,964,565.01
Interest and Rents due and accrued	9,291,253.31
Premiums due and deferred	9,331,486.79
Total	**$790,935,395.61**

LIABILITIES

Policy Reserve	$651,889,465.00
Other Policy Liabilities	11,856,997.88
Premiums and Interest prepaid	4,048,933.57
Commissions, Salaries, Taxes, etc	1,333,293.05
Dividends payable in 1915	17,104,119.86
Reserve for Deferred Dividends	88,902,104.00
Reserves for other purposes	15,800,482.25
Total	**$790,935,395.61**

INCOME, 1914

Premiums:		
On New Policies	$9,061,420.82	
On Renewed Policies	79,153,606.31	
Annuities, etc	2,252,150.86	
		$90,467,177.99
Real Estate Rentals		693,969.50
Interest on Mortgages		7,509,010.87
Interest on Policy Loans		7,158,715.58
Interest on Bonds		19,293,228.99
Interest on Bank Deposits, etc		284,474.61
Profit on Sale or Maturity of Assets		30,263.58
Increase by adjustment in Book Value of Ledger Assets		256,967.41
Other Income		572,766.11
Total		**$126,266,574.64**

DISBURSEMENTS, 1914

Payments to Policy-holders:		
Death Losses	$26,269,756.21	
To Living Policy-holders	45,693,673.36	
		$71,963,429.57
Paid under supplementary contracts and other payments		365,019.12
Com'ns and other Pay'ts to Agents		6,831,867.23
Medical Examination and Agency Expenses, etc		2,657,836.44
Home Office Salaries		1,786,881.72
Taxes, Licenses and Insurance Dept. Fees		1,190,478.01
Rent and Real Estate Taxes and Expenses		887,186.65
All other Expenses		1,269,732.81
Loss on Sale or Maturity of Assets		621,589.06
Decrease by adjustment in Book Values		1,704,666.22
For Reserves to meet Policy Obligations		36,987,887.81
Total		**$126,266,574.64**